MKO Planning and Environmental Consultants

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PLANNING SECTION
29 JUL 2020
SLIGO CO. CO.

Environmental Impact Assessment Report

Proposed Croagh Wind Farm,

Co. Leitrim and Co. Sligo
Volume 3b
EIAR Appendices 7-1 – 14-2

Volume 3b: Appendices 7-1 – 14-2

Table of Contents

Appendix 7-1 Target Species List

Appendix 7-2 Bird Survey Effort

Appendix 7-3 Results Summary Tables

Appendix 7-4 Bird Survey Data

Appendix 7-5 Vantage Point No. 2 – Survey Data

Appendix 7-6 Collision Risk Modelling Assessment

Appendix 7-7 Bird Monitoring Programme

Appendix 8-1 Geotechnical and Peat Stability Assessment Report

Appendix 9-1 Flood Risk Assessment

Appendix 9-2 Lab Certificates

Appendix 9-3 Site Cross Sections

Appendix 10-1 Carbon Loss Calculation

Appendix 11-1 Glossary of Acoustic Terminology

Appendix 11-2 Calibration Certificates

Appendix 11-3 Modelling Assumptions

Appendix 11-4 Details of Other Wind Farms

Appendix 11-5 Noise Contour at Rate Power and Wind Speed

Appendix 11-6 Directional Noise Predictions - Cumulative

Appendix 12-1 LVIA Methodology

Appendix 12-2 Landscape Character Assessment Tables

Appendix 12-3 Viewpoints Assessment

Appendix 12-4 ZTV, Viewpoints, Landscape Designations and Cumulative Baseline Map

Appendix 14-1 Autotrack Assessment

Appendix 14-2 Outline Traffic Management Plan

SEE FURTHER VOLUMES:

Volume 3a - Appendices 2-1 to 6-5

PLANNING SECTION
29 JUL 2020

APPENDIX 7-1

TARGET SPECIES LIST

Table of Contents

TABLE OF TABLES

Table 1-1 Target Species List 2
Table 1-2 Species Recorded On-Site 3

1. APPENDIX 7-1 (SPECIES LIST)

Table 1-1 Target Species List

Species	Latin Name	Rationale
Whooper Swan	*Cygnus cygnus*	Annex I EU Birds Directive
Golden Plover	*Pluvialis apricaria*	Annex I EU Birds Directive, BoCCI Red Listed
Hen Harrier	*Circus cyaneus*	Annex I EU Birds Directive
Merlin	*Falco columbarius*	Annex I EU Birds Directive
Peregrine	*Falco peregrinus*	Annex I EU Birds Directive
Red Grouse	*Lagopus lagopus*	BoCCI Red Listed (Breeding Populations Only)
Woodcock	*Scolopax rusticola*	BoCCI Red Listed (Breeding Populations Only)
Curlew	*Numenius arquata*	BoCCI Red Listed (Breeding & Wintering Populations)
Buzzard	*Buteo buteo*	Schedule IV of the Wildlife Act; 1976 (Raptor Species)
Sparrowhawk	*Accipiter nisus*	Schedule IV of the Wildlife Act; 1976 (Raptor Species)
Kestrel	*Falco tinnunculus*	Schedule IV of the Wildlife Act; 1976 (Raptor Species)
Common Snipe	*Gallinago gallinago*	BoCCI Amber Listed (Breeding & Wintering Populations)

Table 1-2 Species Recorded On-Site

Species	Latin Name	Target Spp. Y/N
Whooper Swan	*Cygnus cygnus*	Yes
Golden Plover	*Pluvialis apricaria*	Yes
Hen Harrier	*Circus cyaneus*	Yes
Merlin	*Falco columbarius*	Yes
Peregrine	*Falco peregrinus*	Yes
Red Grouse	*Lagopus lagopus*	Yes
Woodcock	*Scolopax rusticola*	Yes
Curlew	*Numenius arquata*	Yes
Buzzard	*Buteo buteo*	Yes
Sparrowhawk	*Accipiter nisus*	Yes
Kestrel	*Falco tinnunculus*	Yes
Common Snipe	*Gallinago gallinago*	Yes
Meadow Pipit	*Anthus pratensis*	No
Grey Wagtail	*Motacilla cinerea*	No
Kittiwake	*Rissa tridactyla*	No
Common Gull	*Larus canus*	No
Lesser Black-backed Gull	*Larus fuscus*	No
Cormorant	*Phalacrocorax carbo*	No
Grey Heron	*Ardea cinerea*	No
Scaup	*Aythya marila*	No
Mallard	*Anas platyrhynchos*	No
Pheasant	*Phasianus colchicus*	No
Raven	*Corvus corax*	No
Carrion Crow	*Corvus corone*	No
Hooded Crow	*Corvus cornix*	No
Jay	*Garrulus glandarius*	No
Magpie	*Pica pica*	No
Cuckoo	*Cuculus canorus*	No
Grasshopper Warbler	*Locustella naevia*	No
Garden Warbler	*Sylvia borin*	No
Sedge Warbler	*Acrocephalus schoenobaenus*	No
Willow Warbler	*Phylloscopus trochilus*	No
Blackbird	*Turdus merula*	No
Mistle Thrush	*Turdus viscivorus*	No
Song Thrush	*Turdus philomelos*	No
Fieldfare	*Turdus pilaris*	No
Redwing	*Turdus iliacus*	No
Skylark	*Alauda arvensis*	No

Species	Latin Name	Target Spp. Y/N
Reed Bunting	*Emberiza schoeniclus*	No
House Martin	*Delichon urbicum*	No
Swallow	*Hirundo rustica*	No
Swift	*Apus apus*	No
Wood Pigeon	*Columba palumbus*	No
Collard Dove	*Streptopelia decaocto*	No
Great Tit	*Parus major*	No
Coal Tit	*Parus ater*	No
Blue Tit	*Parus caeruleus*	No
Long-tailed Tit	*Aegithalus caudatus*	No
Bullfinch	*Pyrrhula pyrrhula*	No
Chaffinch	*Fringilla coelebs*	No
Chiffchaff	*Phylloscopus collybita*	No
Crossbill	*Loxia curvirostra*	No
Dunnock	*Prunella modularis*	No
Goldcrest	*Regulus regulus*	No
Goldfinch	*Carduelis carduelis*	No
Lesser Redpoll	*Carduelis flammea cabaret*	No
Linnet	*Carduelis cannabina*	No
Siskin	*Carduelis spinus*	No
Pied Wagtail	*Motacilla alba yarrellii*	No
Robin	*Erithacus rubecula*	No
Stonechat	*Saxicola torquata*	No
Whinchat	*Saxicola rubetra*	No
Treecreeper	*Certhia familiaris*	No
Wheatear	*Oenanthe oenanthe*	No
Whitethroat	*Sylvia communis*	No
Wren	*Troglodytes troglodytes*	No

Table of Contents

TABLE OF TABLES

Table 1-1 Core Vantage Point Survey Effort 2
Table 1-2 Breeding Bird (Adapted Brown & Shephard) Survey Effort 41
Table 1-3 Breeding Raptor Survey Effort 50
Table 1-4 Breeding Woodcock Survey Efffort 65
Table 1-5 Red Grouse Survey Effort 67
Table 1-6 Hen Harrier Roost Survey Effort 69
Table 1-7 Winter Transect Survey Effort 80
Table 1-8 Boleybaun Surveys (VP2 Survey Effort) 83

1. APPENDIX 7-2 (SURVEY EFFORT)

Table 1-1 Core Vantage Point Survey Effort

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
25/09/2017	Vantage Point Survey	1	01:00 starting at 13:55	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None		LD
25/09/2017	Vantage Point Survey	1	01:00 starting at 14:55	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None		LD
25/09/2017	Vantage Point Survey	1	01:00 starting at 15:55	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None		LD
25/09/2017	Vantage Point Survey	1	03:00 starting at 17:25	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		LD
25/10/2017	Vantage Point Survey	1	06:30 starting at 12:43	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		CP

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
10/11/2017	Vantage Point Survey	1	02:00 starting at 11:12	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None		LD
10/11/2017	Vantage Point Survey	1	01:00 starting at 13:12	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None		LD
10/11/2017	Vantage Point Survey	1	00:10 starting at 14:52	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Limited (<500m); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Rain; Frost: None ; Snow: None	Rain and reduced visibilty moving in from the west at the end of the third hour, during the break and increasing at the beginning of the second survey period. Second session abandoned.	LD
11/11/2017	Vantage Point Survey	1	02:00 starting at 14:40	Wind Speed and Direction:Calm, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Survey resumed and completed from yesterday. More Golden Plover calling from the area where the birds were flushed yesterday.	LD
11/11/2017	Vantage Point Survey	1	01:00 starting at 16:40	Wind Speed and Direction:Calm, W; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Survey resumed and completed from yesterday. More Golden Plover calling from the area where the birds were flushed yesterday.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
20/12/2017	Vantage Point Survey	1	03:00 starting at 07:50	Wind Speed and Direction:, sw; Visibility: Poor (<km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Drizzle Mist; Frost: None ; Snow: None		DM
20/12/2017	Vantage Point Survey	1	01:00 starting at 11:20	Wind Speed and Direction:Calm, ; Visibility: Poor (<km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Drizzle Mist; Frost: None ; Snow: None		DM
20/12/2017	Vantage Point Survey	1	02:00 starting at 12:20	Wind Speed and Direction:Calm, ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
25/01/2018	Vantage Point Survey	1	03:00 starting at 11:28	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Regular, heavy showers all day long and strong gusting winds. Very quiet, bar the flock of Golden Plover (see Incidentals).	LD
25/01/2018	Vantage Point Survey	1	03:00 starting at 14:58	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Regular, heavy showers all day long and strong gusting winds. Very quiet, bar the flock of Golden Plover (see Incidentals).	LD
24/02/2018	Vantage Point Survey	1	03:00 starting at 12:28	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	16 GP observed. Haze obscured distant landscape	RW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
24/02/2018	Vantage Point Survey	1	03:00 starting at 15:58	Wind Speed and Direction:Light Breeze, SE; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	1 BZ observed. Haze obscured distant landscape	RW
21/03/2018	Vantage Point Survey	1	03:00 starting at 13:18	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Another breezy day, with few birds seen in flight. No sign of the large flock of Golden Plover here this time, or any Red Grouse. Three birds were heard calling nearby at VP3 last night, although the condisions were much more settled.	LD
21/03/2018	Vantage Point Survey	1	02:00 starting at 16:48	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Another breezy day, with few birds seen in flight. No sign of the large flock of Golden Plover here this time, or any Red Grouse. Three birds were heard calling nearby at VP3 last night, although the condisions were much more settled.	LD
21/03/2018	Vantage Point Survey	1	01:00 starting at 18:48	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Another breezy day, with few birds seen in flight. No sign of the large flock of Golden Plover here this time, or any Red Grouse. Three birds were heard calling nearby at VP3 last night, although the condisions were much more settled.	LD
04/04/2018	Vantage Point Survey	1	06:04 starting at 07:26	Wind Speed and Direction:Light Breeze, N; Visibility: Limited (<500m); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		SF
02/05/2018	Vantage Point Survey	1	06:19 starting at 06:11	Wind Speed and Direction:Light Breeze, WNW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 10 Rain: None; Frost: None ; Snow: None		SHAY FENNELLY

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
14/06/2018	Vantage Point Survey	1	03:00 starting at 12:30	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: Light Showers; Frost: None; Snow: None	No sightings	RW
14/06/2018	Vantage Point Survey	1	03:00 starting at 16:00	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None; Snow: None	No sightings	RW
29/07/2018	Vantage Point Survey	1	03:00 starting at 10:51	Wind Speed and Direction:Light Air, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None	No sightings	RW
29/07/2018	Vantage Point Survey	1	03:00 starting at 14:21	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	No sightings	RW
28/08/2018	Vantage Point Survey	1	01:00 starting at 08:00	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
28/08/2018	Vantage Point Survey	1	02:00 starting at 09:00	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
28/08/2018	Vantage Point Survey	1	03:00 starting at 11:30	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
18/09/2018	Vantage Point Survey	1	02:00 starting at 06:10	Wind Speed and Direction:Gentle Breeze, sw; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
18/09/2018	Vantage Point Survey	1	01:00 starting at 08:10	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Moderate (1-2km); Cloud Height: ; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
18/09/2018	Vantage Point Survey	1	01:00 starting at 09:40	Wind Speed and Direction:Gentle Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
18/09/2018	Vantage Point Survey	1	02:00 starting at 10:40	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
23/10/2018	Vantage Point Survey	1	01:00 starting at 12:45	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
23/10/2018	Vantage Point Survey	1	01:00 starting at 13:45	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
23/10/2018	Vantage Point Survey	1	01:00 starting at 14:45	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
23/10/2018	Vantage Point Survey	1	01:00 starting at 16:15	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
23/10/2018	Vantage Point Survey	1	01:00 starting at 17:15	Wind Speed and Direction:Gentle Breeze, W; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
23/10/2018	Vantage Point Survey	1	01:00 starting at 18:15	Wind Speed and Direction:Gentle Breeze, W; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
29/11/2018	Vantage Point Survey	1	07:00 starting at 07:20	Wind Speed and Direction:, NNW; Visibility: ; Cloud Height: ; Cloud Cover %: 100 Rain: ; Frost: ; Snow:	Very bad visibility most of the time. Low cloud cover. Very gusty SSW 33km/h @12pm, scatted showers.	AM
03/12/2018	Vantage Point Survey	1	06:00 starting at 07:40	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: <33 Rain: None; Frost: None ; Snow: None		JK

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
15/01/2019	Vantage Point Survey	1	06:30 starting at 11:00	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
07/02/2019	Vantage Point Survey	1	06:30 starting at 11:50	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
26/03/2019	Vantage Point Survey	1	03:00 starting at 06:22	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None	No sightings	RW
26/03/2019	Vantage Point Survey	1	03:00 starting at 09:52	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None	BZ & WS observed	RW
30/04/2019	Vantage Point Survey	1	01:00 starting at 15:00	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
30/04/2019	Vantage Point Survey	1	01:00 starting at 16:00	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
30/04/2019	Vantage Point Survey	1	01:00 starting at 17:00	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
30/04/2019	Vantage Point Survey	1	01:00 starting at 19:00	Wind Speed and Direction:Moderate Breeze, S ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
30/04/2019	Vantage Point Survey	1	01:00 starting at 20:00	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
30/04/2019	Vantage Point Survey	1	01:00 starting at 21:00	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
15/05/2019	Vantage Point Survey	1	01:00 starting at 04:30	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
15/05/2019	Vantage Point Survey	1	00:30 starting at 05:30	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
15/05/2019	Vantage Point Survey	1	01:00 starting at 12:30	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
15/05/2019	Vantage Point Survey	1	01:00 starting at 13:30	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
15/05/2019	Vantage Point Survey	1	01:00 starting at 14:30	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/05/2019	Vantage Point Survey	1	01:00 starting at 11:15	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/05/2019	Vantage Point Survey	1	00:30 starting at 12:15	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
18/06/2019	Vantage Point Survey	1	01:00 starting at 10:25	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	Machine working in clearfell forestry area marked on map, couldn't be heard. It was stocking felled timbed into stacks from 10:25-16:15 when machine stopped and a jeep left the area.	PW
18/06/2019	Vantage Point Survey	1	01:00 starting at 11:25	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	2 vehicles at turbines near VP4 with someone apparently working turf from 10:25.	PW
18/06/2019	Vantage Point Survey	1	01:00 starting at 12:25	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		PW
18/06/2019	Vantage Point Survey	1	01:00 starting at 13:55	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	One car leaves turf, 14:45	PW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
18/06/2019	Vantage Point Survey	1	01:00 starting at 14:55	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None	Both cars gone now, 15:30. Light rain shower.	PW
18/06/2019	Vantage Point Survey	1	01:00 starting at 15:55	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	At 16:52 a van moved in the clearfell area and the machine began working again.	PW
18/07/2019	Vantage Point Survey	1	06:30 starting at 11:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Heavy Showers; Frost: None ; Snow: None		JK
07/08/2019	Vantage Point Survey	1	06:30 starting at 16:00	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
04/09/2019	Vantage Point Survey	1	01:00 starting at 05:50	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
04/09/2019	Vantage Point Survey	1	01:00 starting at 06:50	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 33-66 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
04/09/2019	Vantage Point Survey	1	01:00 starting at 07:50	Wind Speed and Direction:Fresh Breeze, W; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
04/09/2019	Vantage Point Survey	1	01:00 starting at 09:40	Wind Speed and Direction:Strong Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		AOD
04/09/2019	Vantage Point Survey	1	01:00 starting at 10:40	Wind Speed and Direction:Strong Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None		AOD
04/09/2019	Vantage Point Survey	1	01:00 starting at 11:40	Wind Speed and Direction:Strong Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None		AOD
26/09/2017	Vantage Point Survey	3	03:00 starting at 13:52	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		LD
26/09/2017	Vantage Point Survey	3	01:00 starting at 17:22	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
26/09/2017	Vantage Point Survey	3	02:00 starting at 18:22	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		LD
24/10/2017	Vantage Point Survey	3	06:30 starting at 12:46	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Showers second half; Frost: None ; Snow: None		CP
15/11/2017	Vantage Point Survey	3	01:00 starting at 11:03	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Had to abandon the second half of the VP survey due to thick fog and increasingly reduced visibilty. Occasional mist rolling in, visibilty was good for the vast majority of the first three hours beforehand.	LD
15/11/2017	Vantage Point Survey	3	01:00 starting at 12:03	Wind Speed and Direction:Gentle Breeze, S; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Had to abandon the second half of the VP survey due to thick fog and increasingly reduced visibilty. Occasional mist rolling in, visibilty was good for the vast majority of the first three hours beforehand.	LD
15/11/2017	Vantage Point Survey	3	01:00 starting at 13:03	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Had to abandon the second half of the VP survey due to thick fog and increasingly reduced visibilty. Occasional mist rolling in, visibilty was good for the vast majority of the first three hours beforehand.	LD
15/11/2017	Vantage Point Survey	3	00:37 starting at 14:33	Wind Speed and Direction:Gentle Breeze, S; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Had to abandon the second half of the VP survey due to thick fog and increasingly reduced visibilty. Occasional mist rolling in, visibilty was good for the vast majority of the first three hours beforehand.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
20/11/2017	Vantage Point Survey	3	01:00 starting at 14:26	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Continued and completd from 15/11/17. Occasional light rain and mist in the distance. Very quiet again.	LD
20/11/2017	Vantage Point Survey	3	01:00 starting at 15:26	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Continued and completd from 15/11/17. Occasional light rain and mist in the distance. Very quiet again.	LD
20/11/2017	Vantage Point Survey	3	01:00 starting at 16:26	Wind Speed and Direction:Light Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Continued and completd from 15/11/17. Occasional light rain and mist in the distance. Very quiet again.	LD
15/12/2017	Vantage Point Survey	3	03:00 starting at 07:45	Wind Speed and Direction:Moderate Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None		DM
15/12/2017	Vantage Point Survey	3	03:00 starting at 11:15	Wind Speed and Direction:Moderate Breeze, mw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None		DM
23/01/2018	Vantage Point Survey	3	02:00 starting at 11:25	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very strong breeze all day, gusting to gale force winds on occasion. Very quiet, and only saw one bird (the Jay) in flight all day.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
23/01/2018	Vantage Point Survey	3	01:00 starting at 13:25	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	Very strong breeze all day, gusting to gale force winds on occasion. Very quiet, and only saw one bird (the Jay) in flight all day.	LD
23/01/2018	Vantage Point Survey	3	01:00 starting at 14:55	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Very strong breeze all day, gusting to gale force winds on occasion. Very quiet, and only saw one bird (the Jay) in flight all day.	LD
23/01/2018	Vantage Point Survey	3	02:00 starting at 15:55	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Very strong breeze all day, gusting to gale force winds on occasion. Very quiet, and only saw one bird (the Jay) in flight all day.	LD
25/02/2018	Vantage Point Survey	3	02:17 starting at 16:01	Wind Speed and Direction:Strong Breeze, S; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Another blustery day, with thhin, low lying cloud in the distant valley. That thickened up during the morning, but visibilty was stil greater or equal to 1km. Very few birds. Very cold and quiet.	LD
25/02/2018	Vantage Point Survey	3	02:17 starting at 16:01	Wind Speed and Direction:Strong Breeze, S; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Another blustery day, with thhin, low lying cloud in the distant valley. That thickened up during the morning, but visibilty was stil greater or equal to 1km. Very few birds. Very cold and quiet.	LD
15/03/2018	Vantage Point Survey	3	02:00 starting at 13:06	Wind Speed and Direction:Strong Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None; Snow: None	Survey suspended after three hours because of the increasing strength of the wind. Increasing to gale force, with all birds gone to ground.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
15/03/2018	Vantage Point Survey	3	02:00 starting at 16:06	Wind Speed and Direction:Strong Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None; Snow: Ground	Survey suspended after three hours because of the increasing strength of the wind. Increasing to gale force, with all birds gone to ground.	LD
20/03/2018	Vantage Point Survey	3	02:00 starting at 16:46	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None; Snow: None	Very calm and settled day. Stilll very cold, with frozen water and ice on the ground. A few birds in flight and also three Red Grouse calling at dusk. Survey completed from 15/3/2018.	LD
20/03/2018	Vantage Point Survey	3	1:00 starting at 18:46	Wind Speed and Direction:Calm, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None; Snow: None	Very calm and settled day. Stilll very cold, with frozen water and ice on the ground. A few birds in flight and also three Red Grouse calling at dusk. Survey completed from 15/3/2018.	LD
10/04/2018	Vantage Point Survey	3	06:30 starting at 06:30	Wind Speed and Direction:Light Breeze, E; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None	VISIBILITY IMPROVED OVER WATCH	SF
03/05/2018	Vantage Point Survey	3	06:30 starting at 05:00	Wind Speed and Direction:Gentle Breeze, SSW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None	DRY FOLLOWED BY SHOWERS AND CLOUD BUT VIS=2KM	SHAY FENNELLY
21/06/2018	Vantage Point Survey	3	03:00 starting at 11:00	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None; Snow: None	K & HH observed	RW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
21/06/2018	Vantage Point Survey	3	03:00 starting at 14:30	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None; Snow: None	K observed	RW
27/07/2018	Vantage Point Survey	3	03:00 starting at 10:17	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	No sightings	RW
27/07/2018	Vantage Point Survey	3	03:00 starting at 13:47	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	No sightings	RW
27/08/2018	Vantage Point Survey	3	01:00 starting at 12:00	Wind Speed and Direction:Light Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Light Showers; Frost: None; Snow: None		DM
27/08/2018	Vantage Point Survey	3	02:00 starting at 13:00	Wind Speed and Direction:Light Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
27/08/2018	Vantage Point Survey	3	03:00 starting at 15:30	Wind Speed and Direction:Light Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
17/09/2018	Vantage Point Survey	3	02:00 starting at 06:10	Wind Speed and Direction:Moderate Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None	6:30 red grouse calling. 7:30 hare seen. 13:00 snipe flushed from bog after vp	DM
17/09/2018	Vantage Point Survey	3	01:00 starting at 08:10	Wind Speed and Direction:Moderate Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Light Showers; Frost: None; Snow: None		DM
17/09/2018	Vantage Point Survey	3	01:00 starting at 09:40	Wind Speed and Direction:Fresh Breeze, s; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
17/09/2018	Vantage Point Survey	3	01:00 starting at 10:40	Wind Speed and Direction:Fresh Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
17/09/2018	Vantage Point Survey	3	01:00 starting at 11:40	Wind Speed and Direction:Fresh Breeze, s; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
26/10/2018	Vantage Point Survey	3	01:00 starting at 13:45	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: Light Showers; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
26/10/2018	Vantage Point Survey	3	01:00 starting at 14:45	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: Light Showers; Frost: None ; Snow: None		AOD
26/10/2018	Vantage Point Survey	3	01:00 starting at 15:45	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
01/11/2018	Vantage Point Survey	3	01:00 starting at 15:00	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	OCTOBER SURVEY	AOD
01/11/2018	Vantage Point Survey	3	01:00 starting at 16:00	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None	OCTOBER SURVEY	AOD
01/11/2018	Vantage Point Survey	3	01:00 starting at 17:00	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None	OCTOBER SURVEY	AOD
30/11/2018	Vantage Point Survey	3	06:00 starting at 07:15	Wind Speed and Direction:Fresh Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60 Rain: None; Frost: None ; Snow: None		J.Kennedy

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
05/12/2018	Vantage Point Survey	3	06:00 starting at 07:40	Wind Speed and Direction:Gentle Breeze, E; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
04/02/2019	Vantage Point Survey	3	06:30 starting at 11:30	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-60 Rain: None; Frost: None ; Snow: Ground	JANUARY SURVEY	JK
25/02/2019	Vantage Point Survey	3	03:00 starting at 12:29	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 90 Rain: None; Frost: None ; Snow: None	No sightings	RW
25/02/2019	Vantage Point Survey	3	03:00 starting at 15:59	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 50 Rain: None; Frost: None ; Snow: None	No sightings	RW
14/03/2019	Vantage Point Survey	3	03:00 starting at 06:51	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 90 Rain: Light Showers; Frost: None ; Snow: None	No sightings	RW
14/03/2019	Vantage Point Survey	3	03:00 starting at 10:21	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 80 Rain: None; Frost: None ; Snow: None	GP, BZ & KI observed	RW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
29/04/2019	Vantage Point Survey	3	01:00 starting at 15:00	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
29/04/2019	Vantage Point Survey	3	01:00 starting at 16:00	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
29/04/2019	Vantage Point Survey	3	01:00 starting at 17:00	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
29/04/2019	Vantage Point Survey	3	01:00 starting at 19:00	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
29/04/2019	Vantage Point Survey	3	01:00 starting at 20:00	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
29/04/2019	Vantage Point Survey	3	01:00 starting at 21:00	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
14/05/2019	Vantage Point Survey	3	01:00 starting at 04:30	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
14/05/2019	Vantage Point Survey	3	01:00 starting at 05:30	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
14/05/2019	Vantage Point Survey	3	01:00 starting at 06:30	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
14/05/2019	Vantage Point Survey	3	01:00 starting at 07:00	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
14/05/2019	Vantage Point Survey	3	01:00 starting at 08:00	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
14/05/2019	Vantage Point Survey	3	01:00 starting at 09:00	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
05/06/2019	Vantage Point Survey	3	01:00 starting at 14:35	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None	Visibility variable 3-4	PW
05/06/2019	Vantage Point Survey	3	01:00 starting at 15:35	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None	Visibility variable 1-2	PW
05/06/2019	Vantage Point Survey	3	01:00 starting at 16:35	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None	Visibility variable 1-2, 1. Poor visiblity throughout whole survey, getting worse to no visibility at last 30 minutes. Low cloud rolling by all the time.	PW
14/06/2019	Vantage Point Survey	3	01:00 starting at 14:00	Wind Speed and Direction:Calm, ; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None	Machine heard working in forest for the first 2 hours of the survey. One person working turf northwest of VP3.	PW
14/06/2019	Vantage Point Survey	3	01:00 starting at 15:00	Wind Speed and Direction:Light Air, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None	Two people working turf northwest of VP3.	PW
14/06/2019	Vantage Point Survey	3	01:00 starting at 16:00	Wind Speed and Direction:Calm, ; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None	One person working turf northwest of VP3	PW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
02/07/2019	Vantage Point Survey	3	06:30 starting at 11:00	Wind Speed and Direction:Light Air, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
13/08/2019	Vantage Point Survey	3	06:30 starting at 15:45	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-60 Rain: Heavy Showers; Frost: None ; Snow: None		JK
05/09/2019	Vantage Point Survey	3	01:00 starting at 05:50	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
05/09/2019	Vantage Point Survey	3	01:00 starting at 06:50	Wind Speed and Direction:Light Breeze, NW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
05/09/2019	Vantage Point Survey	3	01:00 starting at 07:50	Wind Speed and Direction:Moderate Breeze, W; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
05/09/2019	Vantage Point Survey	3	01:00 starting at 09:40	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
05/09/2019	Vantage Point Survey	3	01:00 starting at 10:40	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
05/09/2019	Vantage Point Survey	3	01:00 starting at 11:40	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
29/09/2017	Vantage Point Survey	4	01:00 starting at 13:47	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	A couple of heavy downpours, but otherwise bright. Breezy early on	LD
29/09/2017	Vantage Point Survey	4	01:00 starting at 14:47	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A couple of heavy downpours, but otherwise bright. Breezy early on	LD
29/09/2017	Vantage Point Survey	4	01:00 starting at 15:47	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	A couple of heavy downpours, but otherwise bright. Breezy early on	LD
29/09/2017	Vantage Point Survey	4	01:00 starting at 17:17	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A couple of heavy downpours, but otherwise bright. Breezy early on	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
29/09/2017	Vantage Point Survey	4	01:00 starting at 18:17	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	A couple of heavy downpours, but otherwise bright. Breezy early on	LD
29/09/2017	Vantage Point Survey	4	01:00 starting at 19:17	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A couple of heavy downpours, but otherwise bright. Breezy early on	LD
26/10/2017	Vantage Point Survey	4	06:30 starting at 12:41	Wind Speed and Direction:Light Breeze, N; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		CP
17/11/2017	Vantage Point Survey	4	01:00 starting at 11:00	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Breezy, with bright interludes, but very quiet. Moved VP slightly to G 86247 23347.	LD
17/11/2017	Vantage Point Survey	4	01:00 starting at 12:00	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Breezy, with bright interludes, but very quiet. Moved VP slightly to G 86247 23347.	LD
17/11/2017	Vantage Point Survey	4	01:00 starting at 13:00	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Breezy, with bright interludes, but very quiet. Moved VP slightly to G 86247 23347.	LD
17/11/2017	Vantage Point Survey	4	01:00 starting at 14:30	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Breezy, with bright interludes, but very quiet. Moved VP slightly to G 86247 23347.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
17/11/2017	Vantage Point Survey	4	01:00 starting at 15:30	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Breezy, with bright interludes, but very quiet. Moved VP slightly to G 86247 23347.	LD
17/11/2017	Vantage Point Survey	4	01:00 starting at 16:30	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Breezy, with bright interludes, but very quiet. Moved VP slightly to G 86247 23347.	LD
13/12/2017	Vantage Point Survey	4	01:00 starting at 07:45	Wind Speed and Direction:Moderate Breeze, w; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: Ground		DM
13/12/2017	Vantage Point Survey	4	02:00 starting at 08:45	Wind Speed and Direction:Moderate Breeze, w; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: Ground		DM
13/12/2017	Vantage Point Survey	4	02:00 starting at 11:15	Wind Speed and Direction:Moderate Breeze, w; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: Ground		DM
13/12/2017	Vantage Point Survey	4	01:00 starting at 13:45	Wind Speed and Direction:Moderate Breeze, w; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: Ground		DM

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
03/02/2018	Vantage Point Survey	4	01:00 starting at 11:46	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Light Showers; Frost: None ; Snow: None	JANUARY SURVEY Quiet again here as usual for winter, non-breeding surveys. Heavy showers, but bbright in between.	LD
03/02/2018	Vantage Point Survey	4	02:00 starting at 12:46	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	JANUARY SURVEY Quiet again here as usual for winter, non-breeding surveys. Heavy showers, but bbright in between.	LD
03/02/2018	Vantage Point Survey	4	01:00 starting at 15:16	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	JANUARY SURVEY Quiet again here as usual for winter, non-breeding surveys. Heavy showers, but bbright in between.	LD
03/02/2018	Vantage Point Survey	4	02:00 starting at 16:16	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	JANUARY SURVEY Quiet again here as usual for winter, non-breeding surveys. Heavy showers, but bbright in between.	LD
17/02/2018	Vantage Point Survey	4	02:17 starting at 16:01	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 2 Rain: None; Frost: Heavy; Snow: None	Cold, crisp clear day. Snow and ice present on the ground, with winds gradually increasing from the south west.	LD
17/02/2018	Vantage Point Survey	4	02:17 starting at 16:01	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 1 Rain: None; Frost: Heavy; Snow: None	Cold, crisp clear day. Snow and ice present on the ground, with winds gradually increasing from the south west.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
17/02/2018	Vantage Point Survey	4	02:17 starting at 16:01	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 1 Rain: None; Frost: Heavy; Snow: None	Cold, crisp clear day. Snow and ice present on the ground, with winds gradually increasing from the south west.	LD
17/02/2018	Vantage Point Survey	4	02:17 starting at 16:01	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 1 Rain: None; Frost: Heavy; Snow: None	Cold, crisp clear day. Snow and ice present on the ground, with winds gradually increasing from the south west.	LD
10/03/2018	Vantage Point Survey	4	01:00 starting at 12:57	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None; Snow: Ground	Low lying mist, with drizzle and the odd heavy shower, but brightening throughout with a fresh breeze. Some snow, but mostly melted. Very quiet.	LD
10/03/2018	Vantage Point Survey	4	01:00 starting at 13:57	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: Light Showers; Frost: None; Snow: Ground	Low lying mist, with drizzle and the odd heavy shower, but brightening throughout with a fresh breeze. Some snow, but mostly melted. Very quiet.	LD
10/03/2018	Vantage Point Survey	4	02:17 starting at 16:01	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None; Snow: Ground	Low lying mist, with drizzle and the odd heavy shower, but brightening throughout with a fresh breeze. Some snow, but mostly melted. Very quiet.	LD
10/03/2018	Vantage Point Survey	4	02:00starting at 16:27	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None; Snow: Ground	Low lying mist, with drizzle and the odd heavy shower, but brightening throughout with a fresh breeze. Some snow, but mostly melted. Very quiet.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
10/03/2018	Vantage Point Survey	4	1:00 starting at 18:27	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: Light Showers; Frost: None; Snow: Ground	Low lying mist, with drizzle and the odd heavy shower, but brightening throughout with a fresh breeze. Some snow, but mostly melted. Very quiet.	LD
29/04/2018	Vantage Point Survey	4	06:25 starting at 05:05	Wind Speed and Direction:Calm, E; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0 Rain: None; Frost: None ; Snow: None	SUNNY	SF
05/05/2018	Vantage Point Survey	4	03:00 starting at 14:15	Wind Speed and Direction:Moderate Breeze, SSW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None	ARRIVE 04:45 LOW CLOUD, GOTO LISSINGROAGH VP02. LOW CLOUD TOO.. DO 3 HOUR SURVEY AT CARRANE HILL VP04. START 14:15-17:15	SHAY FENNELLY
09/05/2018	Vantage Point Survey	4	03:00 starting at 17:00	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 50 Rain: None; Frost: None ; Snow: None	This is dusk survey at carrane hill VP04 (second part)	SHAY FENNELLY
22/06/2018	Vantage Point Survey	4	03:00 starting at 11:12	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None; Snow: None	No sightings	RW
22/06/2018	Vantage Point Survey	4	03:00 starting at 14:42	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None; Snow: None	No sightings	RW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
05/07/2018	Vantage Point Survey	4	03:00 starting at 09:46	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None	1 K. Occ drizzle in 1st hour	RW
05/07/2018	Vantage Point Survey	4	03:00 starting at 13:16	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	1 K.	RW
13/08/2018	Vantage Point Survey	4	01:00 starting at 12:40	Wind Speed and Direction:Light Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
13/08/2018	Vantage Point Survey	4	02:00 starting at 13:40	Wind Speed and Direction:Light Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
13/08/2018	Vantage Point Survey	4	03:00 starting at 16:10	Wind Speed and Direction:Light Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
19/09/2018	Vantage Point Survey	4	01:00 starting at 06:15	Wind Speed and Direction:Moderate Gale, sw; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Heavy Rain; Frost: None; Snow: None		DM

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
19/09/2018	Vantage Point Survey	4	01:00 starting at 07:15	Wind Speed and Direction:Strong Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Heavy Showers; Frost: None; Snow: None		DM
19/09/2018	Vantage Point Survey	4	01:00 starting at 08:15	Wind Speed and Direction:Strong Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Light Showers; Frost: None; Snow: None		DM
20/09/2018	Vantage Point Survey	4	02:00 starting at 10:15	Wind Speed and Direction:Gentle Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
20/09/2018	Vantage Point Survey	4	01:00 starting at 12:15	Wind Speed and Direction:Light Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
18/10/2018	Vantage Point Survey	4	01:00 starting at 14:00	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
18/10/2018	Vantage Point Survey	4	01:00 starting at 15:00	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
18/10/2018	Vantage Point Survey	4	01:00 starting at 16:00	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
18/10/2018	Vantage Point Survey	4	01:00 starting at 17:30	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
18/10/2018	Vantage Point Survey	4	01:00 starting at 18:30	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
22/10/2018	Vantage Point Survey	4	01:00 starting at 15:00	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
01/12/2018	Vantage Point Survey	4	07:00 starting at 07:20	Wind Speed and Direction:, NNE; Visibility: ; Cloud Height: ; Cloud Cover %: 80 Rain: ; Frost: ; Snow:	NOVEMBER SURVEY Scattered showers all morning, patchy clouds.	AM
13/12/2018	Vantage Point Survey	4	03:00 starting at 10:20	Wind Speed and Direction:Strong Breeze, E; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Heavy Rain; Frost: None ; Snow: None		JK

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
19/12/2018	Vantage Point Survey	4	03:00 starting at 07:40	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
14/01/2019	Vantage Point Survey	4	06:30 starting at 11:00	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK
13/02/2019	Vantage Point Survey	4	03:00 starting at 12:43	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A strong breeze on site, with only three species seen in flight and a couple of Passerines calling. No Target Species present.	L. Dark
25/02/2019	Vantage Point Survey	4	01:00 starting at 16:01	Wind Speed and Direction:Fresh Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Strong breeze again on this elevated VP. A few species singing or calling, but no Raptor's or Target Species seen.	L. Dark
25/02/2019	Vantage Point Survey	4	02:00 starting at 17:01	Wind Speed and Direction:Strong Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Strong breeze again on this elevated VP. A few species singing or calling, but no Raptor's or Target Species seen.	L. Dark
25/03/2019	Vantage Point Survey	4	03:00 starting at 06:24	Wind Speed and Direction:Light Air, NW; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 80 Rain: None; Frost: None ; Snow: None	1 K. observed	RW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
25/03/2019	Vantage Point Survey	4	03:00 starting at 09:54	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 50 Rain: None; Frost: None ; Snow: None	No sightings	RW
24/04/2019	Vantage Point Survey	4	02:00 starting at 10:38	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Plenty of Passerines in song, with light rain increasing at the end of the survey. Rain forecast this afternoon, hence the earlier start. No Raptor's or Target Species seen here today.	L. Dark
24/04/2019	Vantage Point Survey	4	01:00 starting at 12:38	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Plenty of Passerines in song, with light rain increasing at the end of the survey. Rain forecast this afternoon, hence the earlier start. No Raptor's or Target Species seen here today.	L. Dark
29/04/2019	Vantage Point Survey	4	02:00 starting at 19:01	Wind Speed and Direction:Moderate Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain and drizzle starting after half an hour, persistent and becoming heavier at the end of the survey. Very quiet session, with few birds seen in flight.	L. Dark
29/04/2019	Vantage Point Survey	4	01:00 starting at 21:01	Wind Speed and Direction:Moderate Breeze, S; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain and drizzle starting after half an hour, persistent and becoming heavier at the end of the survey. Very quiet session, with few birds seen in flight.	L. Dark
16/05/2019	Vantage Point Survey	4	01:00 starting at 04:30	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
16/05/2019	Vantage Point Survey	4	01:00 starting at 05:30	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
16/05/2019	Vantage Point Survey	4	01:00 starting at 06:30	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
16/05/2019	Vantage Point Survey	4	01:00 starting at 08:00	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
16/05/2019	Vantage Point Survey	4	01:00 starting at 09:00	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
16/05/2019	Vantage Point Survey	4	01:00 starting at 10:00	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
13/06/2019	Vantage Point Survey	4	01:00 starting at 13:39	Wind Speed and Direction:Fresh Breeze, NNW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	Man working turf on northwestern side of site near VP3 on moorland.	PW
13/06/2019	Vantage Point Survey	4	01:00 starting at 14:39	Wind Speed and Direction:Moderate Breeze, N; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-	Machine felling in forestry from 15:08. Man working turf on northwestern side of site near VP3 on moorland.	PW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
				100 Rain: None; Frost: None ; Snow: None		
13/06/2019	Vantage Point Survey	4	01:00 starting at 15:39	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		PW
13/06/2019	Vantage Point Survey	4	01:00 starting at 17:10	Wind Speed and Direction:Moderate Breeze, N; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		PW
13/06/2019	Vantage Point Survey	4	01:00 starting at 18:10	Wind Speed and Direction:Moderate Breeze, N; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None	Van drove down through forestry down from 4 turbines on western side of site.	PW
13/06/2019	Vantage Point Survey	4	01:00 starting at 19:10	Wind Speed and Direction:Moderate Breeze, N; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		PW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
01/07/2019	Vantage Point Survey	4	06:30 starting at 11:30	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
27/08/2019	Vantage Point Survey	4	06:30 starting at 15:15	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Heavy Showers; Frost: None ; Snow: None		JK
06/09/2019	Vantage Point Survey	4	01:00 starting at 05:50	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	NO TARGETS	AOD
06/09/2019	Vantage Point Survey	4	01:00 starting at 06:50	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
06/09/2019	Vantage Point Survey	4	01:00 starting at 07:50	Wind Speed and Direction:Fresh Breeze, W; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		AOD
06/09/2019	Vantage Point Survey	4	01:00 starting at 09:20	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
06/09/2019	Vantage Point Survey	4	01:00 starting at 10:20	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		AOD
06/09/2019	Vantage Point Survey	4	01:00 starting at 11:20	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Table 1-2 Breeding Bird (Adapted Brown & Shephard) Survey Effort

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
11/04/2018	Breeding Walkover Survey	West	06:16 starting at 11:57	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Plenty of Passerines in song, but no Target Species or raptors.	LD
13/04/2018	Breeding Walkover Survey	North	03:06 starting at 10:48	Wind Speed and Direction:Light Air, SW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Early mist lifting and plenty of birds in song around the site. No target species or Raptors.	LD
26/04/2018	Breeding Walkover Survey	North	03:14 starting at 10:26	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Breezy day, but shetered along the tracks and lines of conifers. See also Incidentals.	LD
26/04/2018	Breeding Walkover Survey	West	02:51 starting at 14:10	Wind Speed and Direction:Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Fairly strong westerly winds, and occassional light rian throughout. Two Cuckoo's and three Snipe flushed and/or in song. See Incidentals.	LD
27/04/2018	Breeding Walkover Survey	West	03:41 starting at 12:23	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	Heavy showers and hail at times, but still lot's of birds calling and in song.	LD
06/05/2018	Breeding Walkover Survey	North East -	01:00 starting at 08:14	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Low lying cloud and mist, gradually clearing. Plenty of Passerines in song and also a possible Merlin. See Raptor tab for report.	LD
06/05/2018	Breeding Walkover Survey	North East -	02:17 starting at 09:14	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Low lying cloud and mist, gradually clearing. Plenty of Passerines in song and also a possible Merlin. See Raptor tab for report.	LD

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
07/05/2018	Breeding Walkover Survey	North East -	03:10 starting at 08:14	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	No Raptors or target species observed, but plenty of birds in song, including another couple of Cuckoo's. Another breezy day but sheltered in and around the conifers.	LD
26/05/2018	Breeding Walkover Survey	North East -	01:00 starting at 10:43	Wind Speed and Direction:Fresh Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Strong breeze in exposed areas but sheltered alongside the conifers and lot's of breeding birds in song.	LD
26/05/2018	Breeding Walkover Survey	South-West	02:21 starting at 11:43	Wind Speed and Direction:Fresh Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Strong breeze in exposed areas but sheltered alongside the conifers and lot's of breeding birds in song.	LD
29/05/2018	Breeding Walkover Survey	South-West	02:00 starting at 07:50	Wind Speed and Direction:Moderate Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm, sunny day and lots of birds in song.	LD
29/05/2018	Breeding Walkover Survey	South-West	04:19 starting at 09:50	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm, sunny day and lots of birds in song.	LD
30/05/2018	Breeding Walkover Survey	South-West	05:42 starting at 07:32	Wind Speed and Direction:Moderate Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm day again with lots of birds in song. Moorland section predominantly seeing and hearing Meadow Pipit's displaying in flight, alongside a few Skylarks above the heather and Molinia moorland. See also Incidentals.	LD
06/06/2018	Breeding Walkover Survey	North	02:00 starting at 13:38	Wind Speed and Direction:Light Breeze, E; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm and sunny today, with plenty of Passerines in song, although there was disturbance from heavy plant and machinery at the quarry. See map.	LD

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
06/06/2018	Breeding Walkover Survey	North	01:08 starting at 15:38	Wind Speed and Direction:Light Air, E; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm and sunny today, with plenty of Passerines in song, although there was disturbance from heavy plant and machinery at the quarry. See map.	LD
07/06/2018	Breeding Walkover Survey	North East	02:00 starting at 09:45	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm, sunny day with lots of birds singing and in flight. No Raptor's present. But good numbers of Cuckoo's again. See Incidentals for Grid References.	LD
07/06/2018	Breeding Walkover Survey	North East	01:11 starting at 11:45	Wind Speed and Direction:Light Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Warm, sunny day with lots of birds singing and in flight. No Raptor's present. But good numbers of Cuckoo's again. See Incidentals for Grid References.	LD
08/06/2018	Breeding Walkover Survey	North East	02:00 starting at 09:52	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Very still, humid morning. Clouds building and thunder at the end of the survey. No Target Species, but plenty of Passerines in song and another two Cuckoo's on site.	LD
08/06/2018	Breeding Walkover Survey	North East	01:08 starting at 11:52	Wind Speed and Direction:Light Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very still, humid morning. Clouds building and thunder at the end of the survey. No Target Species, but plenty of Passerines in song and another two Cuckoo's on site.	LD
24/06/2018	Breeding Walkover Survey	South West	02:53 starting at 06:40	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Moderate breeze, but plenty of birds calling and in song at Carran Hill.	LD
27/06/2018	Breeding Walkover Survey	South East	02:00 starting at 09:38	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm, sunny day with temperatures in the high 20oC's. Passerines in song along the transect routes but starting to become a little quieter now. No Target Species present.	LD

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
27/06/2018	Breeding Walkover Survey	South East	01:05 starting at 11:38	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm, sunny day with temperatures in the high 20oC's. Passerines in song along the transect routes but starting to become a little quieter now. No Target Species present.	LD
28/06/2018	Breeding Walkover Survey	South West	04:07 starting at 06:36	Wind Speed and Direction:Light Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Another clear and very warm, sunny day, with temperatures exceeding 30oC. Plenty of Meadow Pipit's (including juveniles) and a pair of Cuckoo's, but Raptor's or Target Species present.	LD
10/07/2018	Breeding Walkover Survey		08:05 starting at 09:15	Wind Speed and Direction:Calm, N ; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	SN and RG sighted. Low cloud over hill tops am	RW
12/07/2018	Breeding Walkover Survey		07:50 starting at 09:00	Wind Speed and Direction:Calm, N; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	K sighted	RW
25/07/2018	Breeding Walkover Survey		07:11 starting at 09:32	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	No sightings	RW
16/04/2019	Breeding Walkover Survey	North	02:00 starting at 11:48	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Early morning mist and rain, gradually clearing. Plenty of Passerine's in song, and also flushed a pair of Mallard's from a small pool. See map for location.	L. Dark
16/04/2019	Breeding Walkover Survey	North	03:35 starting at 13:48	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Early morning mist and rain, gradually clearing. Plenty of Passerine's in song, and also flushed a pair of Mallard's from a small pool. See map for location.	L. Dark

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
17/04/2019	Breeding Walkover Survey	South-West-(N)	04:00 starting at 10:52	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Good numbers of Passerine's in song throughout the survey site. Also saw a female Kestrel in flight from a short VP. The bird was flying west from open moorland, carrying an item of prey it had caught. See map for the species location.	L. Dark
17/04/2019	Breeding Walkover Survey	South-West-(N)	02:04 starting at 14:52	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Good numbers of Passerine's in song throughout the survey site. Also saw a female Kestrel in flight from a short VP. The bird was flying west from open moorland, carrying an item of prey it had caught. See map for the species location.	L. Dark
18/04/2019	Breeding Walkover Survey	South-West-(W)	04:00 starting at 10:16	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Lots of Passerine's in song, and also the first Wheatear and Whinchat of the year. Heard a Buzzard calling on and off behind a tall stand of conifers but did not see the bird. Also flushed a Sparrowhawk from scrub. See map for their locations.	L. Dark
18/04/2019	Breeding Walkover Survey	South-West-(W)	02:00 starting at 14:16	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Lots of Passerine's in song, and also the first Wheatear and Whinchat of the year. Heard a Buzzard calling on and off behind a tall stand of conifers but did not see the bird. Also flushed a Sparrowhawk from scrub. See map for their locations.	L. Dark
20/05/2019	Breeding Walkover Survey	North	02:00 starting at 10:16	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A fairly calm day, with broken cloud and spells of sunshine. Plenty of Passerine's in song along the conifer route and also areas of open moorland, but no Raptor's or Target Species seen today.	L. Dark
20/05/2019	Breeding Walkover Survey	North	02:00 starting at 12:16	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud	A fairly calm day, with broken cloud and spells of sunshine. Plenty of Passerine's in song along the	L. Dark

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
				Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	conifer route and also areas of open moorland, but no Raptor's or Target Species seen today.	
20/05/2019	Breeding Walkover Survey	North	01:42 starting at 14:16	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A fairly calm day, with broken cloud and spells of sunshine. Plenty of Passerine's in song along the conifer route and also areas of open moorland, but no Raptor's or Target Species seen today.	L. Dark
21/05/2019	Breeding Walkover Survey	South West (N)	03:00 starting at 09:46	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very calm day, with clouds clearing to warm sunshine on the survey site. Lots of Passerine's in song, including good numbers of Willow Warbler, three Cuckoo's and a few Siskin's in flight. Also saw a Grey Heron along an open area of track. See Walkover tab and map for location.	L. Dark
21/05/2019	Breeding Walkover Survey	South West (N)	03:15 starting at 12:46	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Very calm day, with clouds clearing to warm sunshine on the survey site. Lots of Passerine's in song, including good numbers of Willow Warbler, three Cuckoo's and a few Siskin's in flight. Also saw a Grey Heron along an open area of track. See Walkover tab and map for location.	L. Dark
22/05/2019	Breeding Walkover Survey	South West (W)	04:00 starting at 11:21	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Calm conditions again today. Plenty of birds (primarily Meadow Pipit's and Skylark's over the moor) and also a Snipe drumming in the northern section of the site. Good numbers of Cuckoo as well today, with a pair seen mating over the moorland.	L. Dark
23/05/2019	Breeding Walkover Survey	South West (W)	02:04 starting at 15:21	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Calm conditions again today. Plenty of birds (primarily Meadow Pipit's and Skylark's over the moor) and also a Snipe drumming in the northern section of the site. Good numbers of Cuckoo as well today, with a pair seen mating over the moorland.	L. Dark

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
24/06/2019	Breeding Walkover Survey		01:00 starting at 14:00	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
24/06/2019	Breeding Walkover Survey		01:00 starting at 15:00	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
24/06/2019	Breeding Walkover Survey		01:00 starting at 16:00	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
24/06/2019	Breeding Walkover Survey		01:00 starting at 17:00	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
24/06/2019	Breeding Walkover Survey		01:00 starting at 18:00	Wind Speed and Direction:Calm, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
24/06/2019	Breeding Walkover Survey		01:00 starting at 19:00	Wind Speed and Direction:Calm, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
25/06/2019	Breeding Walkover Survey		01:00 starting at 11:45	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
25/06/2019	Breeding Walkover Survey		01:00 starting at 12:45	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
25/06/2019	Breeding Walkover Survey		01:00 starting at 13:45	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
25/06/2019	Breeding Walkover Survey		01:00 starting at 14:45	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
25/06/2019	Breeding Walkover Survey		01:00 starting at 15:45	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
25/06/2019	Breeding Walkover Survey		01:00 starting at 16:45	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
01/07/2019	Breeding Walkover Survey		01:00 starting at 11:30	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	JUNE SURVEY	AOD
01/07/2019	Breeding Walkover Survey		01:00 starting at 12:30	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	JUNE SURVEY	AOD

Date	Survey Method	Area	Survey Duration	Weather Conditions	Comments	Surveyor
01/07/2019	Breeding Walkover Survey		01:00 starting at 13:30	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	JUNE SURVEY	AOD
01/07/2019	Breeding Walkover Survey		01:00 starting at 14:30	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	JUNE SURVEY	AOD
01/07/2019	Breeding Walkover Survey		01:00 starting at 15:30	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	JUNE SURVEY	AOD
01/07/2019	Breeding Walkover Survey		01:00 starting at 16:30	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	JUNE SURVEY	AOD
16/07/2019	Breeding Walkover Survey	W	02:30 starting at 13:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-60 Rain: None; Frost: None ; Snow: None		JK
22/07/2019	Breeding Walkover Survey	N	03:15 starting at 11:30	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
23/07/2019	Breeding Walkover Survey	SE	02:00 starting at 12:00	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		JK

Table 1-3 Breeding Raptor Survey Effort

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
13/04/2018	Breeding Raptor Survey	East	03:14 starting at 14:14	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Sparrowhawk seen flying low over the ground. See Raptor tab for report. Good views over a large area of conifers and clearfell, but very quiet at the second VP. Dead Badger found (see incidentals).	LD
14/04/2018	Breeding Raptor Survey	North	06:21 starting at 07:14	Wind Speed and Direction:Moderate Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Buzzard heard calling behind the tall conifers in the distance (see map and raptor tab). Also heard Snipe 'Chipping' in wet grassland and Juncus close by and a Garden warbler in song on a recce. See incidentals.	LD
19/04/2018	Breeding Raptor Survey	North	06:06 starting at 11:48	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A pair of Kestrels and a Sparrowhawk seen on site today. See Raptor tab and also incidentals.	LD
21/04/2018	Breeding Raptor Survey	South	06:23 starting at 07:12	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Breezy day with few birds seen in flight. More sheltered in the valley at VP-B and had two male Cuckoo's in song. Also heard Grasshopper Warbler singing. See Incidentals.	LD
22/04/2018	Breeding Raptor Survey	East	06:28 starting at 07:16	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Kestrel seen very briefly flying low over dense grassland on a mountain slope. See Raptor tab and report. Breezy day otherwise, with gusting winds and heavy showers. Cuckoo also heard in song. See Incidentals.	LD
23/04/2018	Breeding Raptor Survey	West	03:15 starting at 14:54	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Breezy day, with gusting winds and no Raptors observed. Snipe 'Chipping' and also Grasshopper Warbler and another Cuckoo in song. See incidentals.	LD

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
06/05/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:00 starting at 11:42	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Low lying cloud and mist this morning, cleared away to brighter skies and a warm afternoon, albeit breezy. Buzzard heard calling near VP-B. see Raptor tab for report.	LD
06/05/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	01:07 starting at 13:42	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Low lying cloud and mist this morning, cleared away to brighter skies and a warm afternoon, albeit breezy. Buzzard heard calling near VP-B. see Raptor tab for report.	LD
07/05/2018	Breeding Raptor survey	West - See field sheet for VP Grid Refs	03:10 starting at 11:42	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Low lying cloud and mist this morning, cleared away to brighter skies and a warm afternoon, albeit breezy. Buzzard heard calling near VP-B. see Raptor tab for report.	LD
10/05/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	02:00 starting at 07:31	Wind Speed and Direction:Strong Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Strong winds again and gusting at times. Sparrowhawk seen again near VP-A. Habitat at VP-B looks very good for Hen Harrier, but none observed.	LD
10/05/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	02:00 starting at 09:31	Wind Speed and Direction:Strong Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Strong winds again and gusting at times. Sparrowhawk seen again near VP-A. Habitat at VP-B looks very good for Hen Harrier, but none observed.	LD
10/05/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	02:13 starting at 11:31	Wind Speed and Direction:Strong Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Strong winds again and gusting at times. Sparrowhawk seen again near VP-A. Habitat at VP-B looks very good for Hen Harrier, but none observed.	LD

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
12/05/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:00 starting at 07:32	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Clear, bright and sunny morning. Gradually clouding in. Lots of Raptor activity today. Kestrel, Buzzards and Sparrowhawk observations. See Raptor tab for report.	LD
12/05/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:00 starting at 09:32	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Clear, bright and sunny morning. Gradually clouding in. Lots of Raptor activity today. Kestrel, Buzzards and Sparrowhawk observations. See Raptor tab for report.	LD
12/05/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:11 starting at 11:32	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Clear, bright and sunny morning. Gradually clouding in. Lots of Raptor activity today. Kestrel, Buzzards and Sparrowhawk observations. See Raptor tab for report.	LD
17/05/2018	Breeding Raptor survey	South - See field sheet for VP Grid Refs	04:00 starting at 09:27	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Fairly breezy day, but a Kestrel seen from VP-B. see Raptor tab for report. See also Incidentals.	LD
17/05/2018	Breeding Raptor survey	South- See field sheet for VP Grid Refs	02:08 starting at 13:27	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Fairly breezy day, but a Kestrel seen from VP-B. see Raptor tab for report. See also Incidentals.	LD
18/05/2018	Breeding Raptor survey	South- See field sheet for VP Grid Refs	03:06 starting at 10:34	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	New VP overlooking a large expanse of valley with upland moors and habitat suitable for Hen Harrier. Breezy day, and very little observed today.	LD

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
26/05/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	02:00 starting at 07:16	Wind Speed and Direction:Fresh Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Breezy on the exposed hills and mountainside at a previous VP, so headed further along a valley to a more sheltered spot and good vantage point overlooking conifers and grasssland. Sparrohwak seen from VP-A.	LD
26/05/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	01:06 starting at 09:16	Wind Speed and Direction:Fresh Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Breezy on the exposed hills and mountainside at a previous VP, so headed further along a valley to a more sheltered spot and good vantage point overlooking conifers and grasssland. Sparrohwak seen from VP-A.	LD
06/06/2018	Breeding Raptor survey	West - See field sheet for VP Grid Refs	02:00 starting at 10:22	Wind Speed and Direction:Gentle Breeze, E; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Warm, sunny day. Possible Hen Harrier foraging from VP-A previously, but no Raptors seen here today.	LD
06/06/2018	Breeding Raptor survey	West - See field sheet for VP Grid Refs	01:06 starting at 12:22	Wind Speed and Direction:Light Breeze, E; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Warm, sunny day. Possible Hen Harrier foraging from VP-A previously, but no Raptors seen here today.	LD
07/06/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	03:06 starting at 06:32	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Still, sunny morning, but no Raptors present. New VP (B) overlooking a large area of open moorland heather and grassland.	LD
08/06/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	02:00 starting at 06:35	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Warm, settled morning. Large areas of conifers and upland moor below VP-B. Looks a very good site and habitat for Hen Harrier, but still none observed.	LD

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
08/06/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	01:07 starting at 08:35	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm, settled morning. Large areas of conifers and upland moor below VP-B. Looks a very good site and habitat for Hen Harrier, but still none observed.	LD
15/06/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:00 starting at 07:06	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Still a fresh to strong breeze today following yesterday's gales. New VP further west, with large open fields and dense grassland which looked good for a foraging or roosting Raptors. None seen today.	LD
15/06/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:00 starting at 09:06	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Still a fresh to strong breeze today following yesterday's gales. New VP further west, with large open fields and dense grassland which looked good for a foraging or roosting Raptors. None seen today.	LD
15/06/2018	Breeding Raptor survey	North - See field sheet for VP Grid Refs	02:09 starting at 11:06	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Still a fresh to strong breeze today following yesterday's gales. New VP further west, with large open fields and dense grassland which looked good for a foraging or roosting Raptors. None seen today. See also Incidentals.	LD
20/06/2018	Breeding Raptor survey	South - See field sheet for VP Grid Refs	02:00 starting at 09:14	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Blustery day and no Raptors seen, despite suitable habitat. Only Meadow Pipit, Hooded Crow and Mistle Thrush seen in flight.	LD
20/06/2018	Breeding Raptor survey	South - See field sheet for VP Grid Refs	04:16 starting at 11:14	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Blustery day and no Raptors seen, despite suitable habitat. Only Meadow Pipit, Hooded Crow and Mistle Thrush seen in flight.	LD

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
23/06/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	03:11 starting at 14:01	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Warm afternoon, with a moderate breeze and light, whispy cloud. Calm and quiet. No Raptors seen.	LD
24/06/2018	Breeding Raptor survey	East - See field sheet for VP Grid Refs	03:04 starting at 09:51	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Bright, warm and sunny day. Kestrel seen in flight at VP-A. see Raptor tab and map.	LD
27/06/2018	Breeding Raptor survey	West - See field sheet for VP Grid Refs	03:00 starting at 06:34	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Calm and bright morning. Ketrel seen in flight over an open area of moorland. See Raptor tab and map for flight-line.	LD
15/07/2018	Breeding Raptor Survey	EAST	06:00 starting at 10:35	Wind Speed and Direction: Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: Heavy Showers; Frost: None ; Snow: None	concentrated on East side of survey area in poor weather conditions....single female K observed from VP7	ED
16/07/2018	Breeding Raptor Survey	WEST	06:00 starting at 09:40	Wind Speed and Direction: Fresh Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	Concentrated on west side no rapters seen.	ED
17/07/2018	Breeding Raptor Survey	SOUTH	06:00 starting at 09:45	Wind Speed and Direction: Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: Light Showers; Frost: None ; Snow: None		ED

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
18/07/2018	Breeding Raptor Survey	NORTH	03:30 starting at 09:05	Wind Speed and Direction: Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	reduced survey in NORTH Section due to area being agricultural and not ideal for breeding raptors	ED
18/07/2018	Breeding Raptor Survey	WEST	03:00 starting at 12:35	Wind Speed and Direction: Light Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	Surveyed most potential sites identified on the WEST Section in the afternoon	ED
19/07/2018	Breeding Raptor Survey	SOUTH	03:00 starting at 09:15	Wind Speed and Direction: Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	Surveyed most potential sites identified on the SOUTH Section in the afternoon	ED
19/07/2018	Breeding Raptor Survey	EAST	03:00 starting at 12:15	Wind Speed and Direction: Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	Surveyed most potential sites identified on the EAST Section in the afternoon	ED
01/04/2019	Breeding Raptor Survey	South	01:00 starting at 07:42	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Modrate breeze blowing in from the west, with light rain and drizzle througout. No Raptor's or Target Species seen.	L. Dark
01/04/2019	Breeding Raptor Survey	South	02:00 starting at 08:42	Wind Speed and Direction:Moderate Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Modrate breeze blowing in from the west, with light rain and drizzle througout. No Raptor's or Target Species seen.	L. Dark
03/04/2019	Breeding Raptor Survey	North	02:00 starting at 11:48	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Fresh to strong breeze today, alongside heavy showers, with bright spells in-between. Fairly quiet at the VP locations, and no Target Species.	L. Dark

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
03/04/2019	Breeding Raptor Survey	North	04:16 starting at 13:48	Wind Speed and Direction:Strong Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	Fresh to strong breeze today, alongside heavy showers, with bright spells in-between. Fairly quiet at the VP locations, and no Target Species.	L. Dark
05/04/2019	Breeding Raptor Survey	South	04:00 starting at 11:21	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A cold day and very quiet. Saw a male Hen Harrier last year at VP3 and also had Curlew calling closeby; but nothing of note was seen today, bar the first House Martins.	L. Dark
05/04/2019	Breeding Raptor Survey	South	02:21 starting at 15:21	Wind Speed and Direction:Moderate Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A cold day and very quiet. Saw a male Hen Harrier last year at VP3 and also had Curlew calling closeby; but nothing of note was seen today, bar the first House Martins.	L. Dark
08/04/2019	Breeding Raptor Survey	North	01:00 starting at 07:31	Wind Speed and Direction:Light Air, E; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Some light rain around, but very calm, albeit very quiet. No Raptor's observed today from the vantage point.	L. Dark
08/04/2019	Breeding Raptor Survey	North	02:00 starting at 08:31	Wind Speed and Direction:Light Breeze, E; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Some light rain around, but very calm, albeit very quiet. No Raptor's observed today from the vantage point.	L. Dark
16/04/2019	Breeding Raptor Survey	North	02:00 starting at 17:28	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Calm and settled evening, but very quiet with no Raptor's seen on site. See also incidentals.	L. Dark
16/04/2019	Breeding Raptor Survey	North	01:00 starting at 19:28	Wind Speed and Direction:Light Air, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Calm and settled evening, but very quiet with no Raptor's seen on site. See also incidentals.	L. Dark

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
25/04/2019	Breeding Raptor Survey	North	04:00 starting at 09:26	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Fairly quiet around VP2, but heard two new Cuckoo arrivals at VP1 and also saw a pair of Buzzard's travelling in flight. See Raptor tab and map for location.	L. Dark
25/04/2019	Breeding Raptor Survey	North	02:25 starting at 13:26	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Fairly quiet around VP2, but heard two new Cuckoo arrivals at VP1 and also saw a pair of Buzzard's travelling in flight. See Raptor tab and map for location.	L. Dark
29/04/2019	Breeding Raptor Survey	South	01:00 starting at 06:45	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A moderate southerly breeze and very quiet, except for a few Hooded Crow's and Raven's in flight over the farmland. No Target Species seen.	L. Dark
29/04/2019	Breeding Raptor Survey	South	02:00 starting at 07:45	Wind Speed and Direction:Moderate Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A moderate southerly breeze and very quiet, except for a few Hooded Crow's and Raven's in flight over the farmland. No Target Species seen.	L. Dark
02/05/2019	Breeding Raptor Survey	North	06:04 starting at 06:02	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Fairly calm day, with low level cloud and a gentle breeze. Saw a pair of Buzzard's soaring initially, then travelling in flight around 0.5km north-west of VP6. Also saw a male Hen Harrier flying further afield >2km outside the buffer. See Incidentals and Breeding Raptor teb for more details.	L. Dark
07/05/2019	Breeding Raptor Survey	East	04:00 starting at 06:04	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A calm, but cold morning looking over two separate valley's. No Raptor's seen on site, but had a Snipe 'drumming' on the sloping hillside, above VP10. Also saw three Mallard's travelling in flight from VP8. See Raptor tab and map for location.	L. Dark

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
07/05/2019	Breeding Raptor Survey	East	02:06 starting at 10:04	Wind Speed and Direction:Calm, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A calm, but cold morning looking over two separate valley's. No Raptor's seen on site but had a Snipe 'drumming' on the sloping hillside, above VP10. Also saw three Mallard's travelling in flight from VP8. See Raptor tab and map for location.	L. Dark
08/05/2019	Breeding Raptor Survey	West	02:00 starting at 14:56	Wind Speed and Direction:Fresh Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Fresh to strong breeze blowing across the moors and open fields, with no Target Species seen today. Did see the first Swifts of the year and some other notable Passerines. See Incidentals.	L. Dark
08/05/2019	Breeding Raptor Survey	West	01:04 starting at 16:56	Wind Speed and Direction:Strong Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Fresh to strong breeze blowing across the moors and open fields, with no Target Species seen today. Did see the first Swifts of the year and some other notable Passerines. See Incidentals.	L. Dark
09/05/2019	Breeding Raptor Survey	West	04:00 starting at 06:00	Wind Speed and Direction:Calm, NE; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Overcast and settled morning, with low lying cloud on the higher hills and showers, turning to rain at the end of the survey. Heard a Snipe chipping from VP 3 on and off throughout in the same location, followed by a second Snipe drumming, further away to the south-east. Also saw what looked like a Buzzard travelling across open mooorland on the way out. see Incidentals and Raptor tab.	L. Dark

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
09/05/2019	Breeding Raptor Survey	West	02:06 starting at 10:00	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Overcast and settled morning, with low lying cloud on the higher hills and showers, turning to rain at the end of the survey. Heard a Snipe chipping from VP 3 on and off throughout in the same location, followed by a second Snipe drumming, further away to the south-east. Also saw what looked like a Buzzard travelling across open mooorland on the way out. see Incidentals and Raptor tab.	L. Dark
22/05/2019	Breeding Raptor Survey	North	02:00 starting at 09:17	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very calm and settled morning, with regular Raptor's in flight. See Breeding Raptor tab for more details.	L. Dark
22/05/2019	Breeding Raptor Survey	North	01:00 starting at 17:31	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very calm and settled morning, with regular Raptor's in flight. See Breeding Raptor tab for more details. NB Survey split due to training new staff.	L. Dark
24/05/2019	Breeding Raptor Survey	East	04:00 starting at 06:04	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very calm morning again, with barely a breath of wind. Saw a Sparrowhawk in flight over conifers from VP9, before it landed in the trees and out of view. Also had numerous Cuckoo's. See Incidentals.	L. Dark
24/05/2019	Breeding Raptor Survey	East	02:08 starting at 10:04	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very calm morning again, with barely a breath of wind. Saw a Sparrowhawk in flight over conifers from VP9, before it landed in the trees and out of view. Also had numerous Cuckoo's. See Incidentals.	L. Dark
08/07/2019	Breeding Raptor Survey	3	02:00 starting at 06:00	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
08/07/2019	Breeding Raptor Survey	4	03:00 starting at 08:30	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
11/07/2019	Breeding Raptor Survey	2	02:00 starting at 06:30	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
11/07/2019	Breeding Raptor Survey	1	02:00 starting at 09:00	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
17/07/2019	Breeding Raptor Survey	5	02:30 starting at 06:20	Wind Speed and Direction:Light Breeze, SW; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Heavy Rain; Frost: None ; Snow: None		JK
17/07/2019	Breeding Raptor Survey	6	02:00 starting at 09:15	Wind Speed and Direction:Light Breeze, SW; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Heavy Rain; Frost: None ; Snow: None		JK
23/07/2019	Breeding Raptor Survey	7	02:30 starting at 09:30	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		JK
24/07/2019	Breeding Raptor Survey	8	02:00 starting at 10:15	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
31/07/2019	Breeding Raptor Survey	9	02:00 starting at 15:30	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
31/07/2019	Breeding Raptor Survey	10	02:00 starting at 17:35	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK
01/06/2019	Breeding Raptor Survey	6 & 7	02:00 starting at 06:06	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Overcast throughout, with a gentle to moderate breeze. Plenty of Passerine's in flight and song, and also a brief view of a Sparrowhawk flying over farmland and scrub. See map for location and Incidentals for noteworthy Passerine's.	L. Dark
01/06/2019	Breeding Raptor Survey	6 & 7	04:05 starting at 08:06	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Overcast throughout, with a gentle to moderate breeze. Plenty of Passerine's in flight and song, and also a brief view of a Sparrowhawk flying over farmland and scrub. See map for location and Incidentals for noteworthy Passerine's.	L. Dark
01/06/2019	Breeding Raptor Survey	8	01:00 starting at 15:07	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Intermittent clouds and clear spells, alongside a moderate breeze and a quiet survey in terms of species. A few notable Passerine's, but no Raptor's or Target Species seen.	L. Dark
01/06/2019	Breeding Raptor Survey	8	02:03 starting at 16:07	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Intermittent clouds and clear spells, alongside a moderate breeze and a quiet survey in terms of species. A few notable Passerine's, but no Raptor's or Target Species seen.	L. Dark

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
02/06/2019	Breeding Raptor Survey	1 & 2	04:00 starting at 06:05	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Fresh breeze this morning, with showers of light rain for part of the survey. Buzzard and a Kestrel (silhouette) seen from VP's 1 & 2. See Breeding Raptor tab and map for location.	L. Dark
02/06/2019	Breeding Raptor Survey	1 & 2	02:07 starting at 10:05	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Fresh breeze this morning, with showers of light rain for part of the survey. Buzzard and a Kestrel (silhouette) seen from VP's 1 & 2. See Breeding Raptor tab and map for location.	L. Dark
03/06/2019	Breeding Raptor Survey	3, 4 & 5	02:00 starting at 04:55	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Winds gradually increasing from the south-west, alongside heavy showers at the end of the survey. Three seperate Snipe seen or heard drumming and/or chipping from the two VP's. See Breeding Raptor tab and map for location.	L. Dark
03/06/2019	Breeding Raptor Survey	3, 4 & 5	04:00 starting at 06:55	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Winds gradually increasing from the south-west, alongside heavy showers at the end of the survey. Three seperate Snipe seen or heard drumming and/or chipping from the two VP's. See Breeding Raptor tab and map for location.	L. Dark
03/06/2019	Breeding Raptor Survey	3, 4 & 5	03:00 starting at 10:55	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	Winds gradually increasing from the south-west, alongside heavy showers at the end of the survey. Three seperate Snipe seen or heard drumming and/or chipping from the two VP's. See Breeding Raptor tab and map for location.	L. Dark

Date	Survey Method	Area/RVP	Survey Duration	Weather Conditions	Comments	Surveyor
04/06/2019	Breeding Raptor Survey	9 & 10	04:00 starting at 06:08	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Overcast day, with fairly light winds. Heard a Snipe chipping in reeds and rough grassland on the hillside above VP 10, which then began drumming in display flight a while later. This was in the same location the bird was observed during the last survey. See Raptor tab and map for location.	L. Dark
04/06/2019	Breeding Raptor Survey	9 & 10	02:04 starting at 10:08	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Overcast day, with fairly light winds. Heard a Snipe chipping in reeds and rough grassland on the hillside above VP 10, which then began drumming in display flight a while later. This was in the same location the bird was observed during the last survey. See Raptor tab and map for location.	L. Dark

Table 1-4 Breeding Woodcock Survey Efffort

Date	Survey Method	Transect/ Area	Survey Duration	Weather Conditions	Comments	Surveyor
08/06/2018	Breeding Woodcock Survey		02:00 starting at 21:05	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 70 Rain: None; Frost: None ; Snow: None		AM
09/06/2018	Breeding Woodcock Survey		02:05 starting at 21:05	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 80 Rain: None; Frost: None ; Snow: None		AM
12/06/2018	Breeding Woodcock Survey		02:00 starting at 21:07	Wind Speed and Direction:Calm, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		AM
18/06/2018	Breeding Woodcock Survey		02:00 starting at 21:10	Wind Speed and Direction:Light Air, W ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 65 Rain: None; Frost: None ; Snow: None		AM
06/05/2019	Breeding Woodcock Survey		02:00 starting at 20:10	Wind Speed and Direction:, SSW; Visibility: ; Cloud Height: ; Cloud Cover %: 90 Rain: ; Frost: ; Snow:	no woodcock or target species	AM
16/05/2019	Breeding Woodcock Survey		02:00 starting at 20:30	Wind Speed and Direction:, ESE; Visibility: ; Cloud Height: ; Cloud Cover %: 60 Rain: ; Frost: ; Snow:	no woodcock or target species	AM
04/06/2019	Breeding Woodcock Survey	1	02:01 starting at 20:58	Wind Speed and Direction:Gentle Breeze, NNW; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None	Continuous light rain.	PW

Date	Survey Method	Transect/ Area	Survey Duration	Weather Conditions	Comments	Surveyor
05/06/2019	Breeding Woodcock Survey	2	01:00 starting at 20:59	Wind Speed and Direction:Light Breeze, NW; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 100 Rain: Heavy Showers; Frost: None ; Snow: None	Very foggy/misty. Limited visibility 50-100m. No woodcock seen.	PW
05/06/2019	Breeding Woodcock Survey	2	01:00 starting at 21:59	Wind Speed and Direction:Light Breeze, NW; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None	Very foggy/misty. Limited visibility 50-100m. No woodcock seen.	PW
12/06/2019	Breeding Woodcock Survey	1	02:05 starting at 21:06	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	3 vans and about 10 people footing/working turf on arrival.	PW
13/06/2019	Breeding Woodcock Survey	2	01:00 starting at 21:07	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		PW
13/06/2019	Breeding Woodcock Survey	2	01:05 starting at 22:07	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		PW

Table 1-5 Red Grouse Survey Effort

Date	Survey Method	Transect	Survey Duration	Weather Conditions	Comments	Surveyor
24/03/2018	Red Grouse Survey	D	00:22 starting at 10:16	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33 Rain: None; Frost: None ; Snow: None		CP
24/03/2018	Red Grouse Survey	E	00:29 starting at 11:01	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33 Rain: None; Frost: None ; Snow: None		CP
24/03/2018	Red Grouse Survey	C	00:39 starting at 13:04	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 50-70 Rain: None; Frost: None ; Snow: None	Sunny intervals	CP
24/03/2018	Red Grouse Survey	A	00:45 starting at 15:40	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 80 Rain: Heavy Showers; Frost: None ; Snow: None	Sunny intervals; cloud bands.	CP
24/03/2018	Red Grouse Survey	B	00:30 starting at 17:00	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 50 Rain: Heavy Showers; Frost: None ; Snow: None	Sunny intervals; cloud bands.	CP
11/03/2019	Red Grouse Survey	B	00:41 starting at 09:20	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None		JC
11/03/2019	Red Grouse Survey	A	00:39 starting at 11:26	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None		JC

Date	Survey Method	Transect	Survey Duration	Weather Conditions	Comments	Surveyor
11/03/2019	Red Grouse Survey	E	00:29 starting at 12:41	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None		JC
11/03/2019	Red Grouse Survey	D	00:35 starting at 14:20	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None		JC
13/03/2019	Red Grouse Survey	C	00:37 starting at 12:08	Wind Speed and Direction:Light Breeze, ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		JC

Table 1-6 Hen Harrier Roost Survey Effort

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
23/10/2017	Hen Harrier Roost Survey	HH01	02:00 starting at 16:50	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: <150m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None	Sunset: 18:20. VP covers southern part of office-mapped area (i.e. south of track and powerline, which forms a visual barrier). No HH activity recorded.	CP
28/10/2017	Hen Harrier Roost Survey	HH02	02:00 starting at 16:37	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Short periods of drizzle; Frost: None ; Snow: None	Sunset: 18:07. VP is at one point considered best of several in a small area. Views are restricted by Birch scrub and small blocks of forestry. The area covered is within the office-mapped "very suitable" area, but does not cover areas further to the west. No HH activity recorded.	CP
29/10/2017	Hen Harrier Roost Survey	HH03	02:00 starting at 15:35	Wind Speed and Direction:Calm, N/A; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	Sunset: 17:05 No HH activity recorded.	CP
30/10/2017	Hen Harrier Roost Survey	HH04	02:00 starting at 14:47	Wind Speed and Direction:Light Air, S; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Short periods of drizzle; Frost: None ; Snow: None	Sunset: 17:03. Some mist/fog. Fog thick in areas outside VP field of view and at greater altitude. No HH activity recorded.	CP
12/12/2017	Hen Harrier Roost Survey	HHVP2	02:00 starting at 14:30	Wind Speed and Direction:Fresh Breeze, sw; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Light Showers; Frost: On site; Snow: Ground		DM

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
12/12/2017	Hen Harrier Roost Survey	HHVP2	00:30 starting at 16:30	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: On site; Snow: Ground		DM
13/12/2017	Hen Harrier Roost Survey	HHVP4	00:50 starting at 14:40	Wind Speed and Direction:Fresh Breeze, w; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: Ground		DM
13/12/2017	Hen Harrier Roost Survey	HHVP4	01:30 starting at 15:30	Wind Speed and Direction:Fresh Breeze, w; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: Ground		DM
18/12/2017	Hen Harrier Roost Survey	HHVP1	01:00 starting at 14:30	Wind Speed and Direction:Gentle Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
18/12/2017	Hen Harrier Roost Survey	HHVP1	01:30 starting at 15:30	Wind Speed and Direction:Gentle Breeze, s; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Drizzle Mist; Frost: None ; Snow: None		DM

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
19/12/2017	Hen Harrier Roost Survey	HHVP3	02:00 starting at 14:30	Wind Speed and Direction:Gentle Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
19/12/2017	Hen Harrier Roost Survey	HHVP3	00:40 starting at 16:30	Wind Speed and Direction:Moderate Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
24/01/2018	Hen Harrier Roost Survey	Site/VP3	01:00 starting at 15:08	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: Heavy Showers; Frost: None ; Snow: None	Gale force winds overnight and strong gusts on site today. Very little bird activity	LD
24/01/2018	Hen Harrier Roost Survey	Site/VP3	01:30 starting at 16:08	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Gale force winds overnight and strong gusts on site today. Very little bird activity	LD
26/01/2018	Hen Harrier Roost Survey	Site/VP1	01:54 starting at 15:30	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain throughout and very heavy at the end. Hare seen on the way out close to the VP. Also, two Woodcocks on the way home.	LD

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
29/01/2018	Hen Harrier Roost Survey	Site/VP2	02:13 starting at 15:32	Wind Speed and Direction:Gentle Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain throughout and heavy at the end. Looks like very good habitat for Hen Harrier to roost, but the best area had a lot of livestock, so it was never going to land there. Flushed a Woodcock on the way out (see incidentals).	LD
05/02/2018	Hen Harrier Roost Survey	Site/VP4	02:16 starting at 15:44	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: All Day	Calm, but very quiet. Couple of birds heard calling, but nothing seen in flight. Light rain turning to quite heavy snow, with reduced visibility at the end.	LD
14/02/2018	Hen Harrier Roost survey	HH03	02:17 starting at 16:01	Wind Speed and Direction:Fresh Breeze, sw; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: On site; Snow: Ground	Cold, crisp day with snow and ice on the ground. Few birds seen in flight, bar a flock of Crossbills. No HH.	LD
15/02/2018	Hen Harrier Roost survey	HH04	02:17 starting at 16:01	Wind Speed and Direction:Fresh Breeze, W; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: On site; Snow: All Day	Heavy snow at the start and end of the survey. Cold and very quiet. No HH.	LD
16/02/2018	Hen Harrier Roost survey	HH01	02:17 starting at 16:01	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: On site; Snow: Ground	Gusting winds, with light rain and snow on site. Very quiet all round. No HH.	LD

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
18/02/2018	Hen Harrier Roost survey	HH02	02:17 starting at 16:01	Wind Speed and Direction:Light Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Very light drizzle throughout and very quiet. The area to the west looks really good for roosting Hen Harrier, but once again has livestock present in the field. No HH.	LD
23/02/2018	Hen Harrier Roost survey	HH04	03:00 starting at 15:26	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		RW
25/02/2018	Hen Harrier Roost survey	HH02	03:00 starting at 15:30	Wind Speed and Direction:Light Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		RW
27/02/2018	Hen Harrier Roost survey	HH03	03:00 starting at 15:34	Wind Speed and Direction:Light Breeze, E; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		RW
28/02/2018	Hen Harrier Roost survey	HH01	03:00 starting at 15:36	Wind Speed and Direction:Gentle Breeze, E; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Light Showers; Frost: None ; Snow: None		RW

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
11/03/2018	Hen Harrier Roost Survey	HH03	01:21 starting at 17:55	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Calm and quiet, with some Passerines such as Song Thrush and Goldcrest singing. No Hen Harriers.	LD
23/03/2018	Hen Harrier Roost Survey	Site 2	02:19 starting at 18:28	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: Light Showers; Frost: None ; Snow: None	Late March so plenty of singing passerines. No HH observed	LD
25/03/2018	Hen Harrier Roost Survey	Site 1	02:19 starting at 18:28	Wind Speed and Direction:Light Air, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	Male Hen Harrier seen at start of the survey, flying low over the ground. Flew east for around 100m before landing in dense heather. Not seen again. Possible Roost.	LD
29/03/2018	Hen Harrier Roost Survey	Site 4	02:19 starting at 18:28	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: Light Showers; Frost: None ; Snow: None	Light rain on and off throughout the survey. Very quiet, only a pair of mistle thrush. No HH	LD
16/10/2018	Hen Harrier Roost Survey	HHVP3	01:00 starting at 17:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
16/10/2018	Hen Harrier Roost Survey	HHVP3	01:00 starting at 18:00	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/10/2018	Hen Harrier Roost Survey	HHVP4	01:00 starting at 17:00	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/10/2018	Hen Harrier Roost Survey	HHVP4	01:00 starting at 18:00	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
19/10/2018	Hen Harrier Roost Survey	HHVP2	01:00 starting at 17:00	Wind Speed and Direction:Light Air, S ; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
19/10/2018	Hen Harrier Roost Survey	HHVP2	01:00 starting at 18:00	Wind Speed and Direction:Light Air, S ; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
26/10/2018	Hen Harrier Roost Survey	HHVP1	01:00 starting at 16:45	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
26/10/2018	Hen Harrier Roost Survey	HHVP1	01:00 starting at 17:45	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
06/11/2018	Hen Harrier Roost Survey	HHVP2	02:00 starting at 15:50	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 55 Rain: None; Frost: None ; Snow: None		J.Kennedy
08/11/2018	Hen Harrier Roost Survey	HHVP3	02:00 starting at 15:44	Wind Speed and Direction:Calm, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33 Rain: None; Frost: None ; Snow: None		J.Kennedy
28/11/2018	Hen Harrier Roost Survey	HHVP4	02:00 starting at 15:15	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None		J.Kennedy
30/11/2018	Hen Harrier Roost Survey	HHVP1	02:00 starting at 15:15	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 100 Rain: Heavy Showers; Frost: None ; Snow: None		J.Kennedy
03/12/2018	Hen Harrier Roost Survey	HH02	02:00 starting at 15:15	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud		JK

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
				Height: >500m; Cloud Cover %: <33 Rain: None; Frost: None ; Snow: None		
05/12/2018	Hen Harrier Roost Survey	HH01	02:00 starting at 15:15	Wind Speed and Direction:Light Breeze, S; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
10/12/2018	Hen Harrier Roost Survey	HH03	02:00 starting at 15:15	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
11/12/2018	Hen Harrier Roost Survey	HH04	02:00 starting at 15:15	Wind Speed and Direction:Moderate Breeze, SE; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK
03/01/2019	Hen Harrier Roost Survey	HH03	02:00 starting at 15:30	Wind Speed and Direction:Light Breeze, NW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
08/01/2019	Hen Harrier Roost Survey	HH02	02:00 starting at 15:30	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
10/01/2019	Hen Harrier Roost Survey	HH04	02:00 starting at 15:30	Wind Speed and Direction:Light Air, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK
24/01/2019	Hen Harrier Roost Survey	HH01	02:00 starting at 16:00	Wind Speed and Direction:Light Breeze, NW; Visibility: No Visibility; Cloud Height: <150m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
07/02/2019	Hen Harrier Roost Survey	HH01	02:00 starting at 07:50	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-60 Rain: None; Frost: None ; Snow: None		JK
12/02/2019	Hen Harrier Roost Survey	HH03	02:14 starting at 15:55	Wind Speed and Direction:Moderate Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	Gusting winds earlier on a VP, but more sheltered here for the Hen Harrier survey. More Passerine's in song than of late, but no Raptor's observed.	L. Dark
13/02/2019	Hen Harrier Roost Survey	HH04	02:14 starting at 16:02	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Stiff breeze all day, and no birds seen in flight on this survey. Very quiet, with no Hen Harrier's observed.	L. Dark
19/02/2019	Hen Harrier Roost Survey	HH02	02:00 starting at 16:50	Wind Speed and Direction:Moderate Breeze, W; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %:		JK

Date	Survey Method	HHVP/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
				100 Rain: Heavy Rain; Frost: None ; Snow: None		
05/03/2019	Hen Harrier Roost Survey	HH01	02:00 starting at 16:45	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK
14/03/2019	Hen Harrier Roost Survey	HH04	02:00 starting at 17:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Heavy Rain; Frost: None ; Snow: None		JK
15/03/2019	Hen Harrier Roost Survey	HH03	02:00 starting at 17:00	Wind Speed and Direction:Light Air, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK
25/03/2019	Hen Harrier Roost Survey	HH02	02:00 starting at 17:30	Wind Speed and Direction:Calm, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK

Table 1-7 Winter Transect Survey Effort

Date	Survey Method	Transect/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
29/10/2017	Winter Walkover Survey		02:25 starting at 11:00	Wind Speed and Direction:Light Air, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 25 Rain: None; Frost: None ; Snow: None		CP
30/10/2017	Winter Walkover Survey		02:30 starting at 11:40	Wind Speed and Direction:Light Breeze, S; Visibility: Poor (<km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Short periods of drizzle; Frost: None ; Snow: None	Some fog second half	CP
18/12/2017	Winter Walkover Survey		01:00 starting at 11:00	Wind Speed and Direction:Gentle Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None		DM
18/12/2017	Winter Walkover Survey		02:15 starting at 12:00	Wind Speed and Direction:Light Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
19/12/2017	Winter Walkover Survey		02:00 starting at 11:00	Wind Speed and Direction:Gentle Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
19/12/2017	Winter Walkover Survey		01:00 starting at 13:00	Wind Speed and Direction:Moderate Breeze, s; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		DM
26/01/2018	Winter Walkover Survey	South	03:04 starting at 12:24	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None		LD

Date	Survey Method	Transect/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
29/01/2018	Winter Walkover Survey	North	03:06 starting at 12:24	Wind Speed and Direction:Strong Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 1 Rain: None; Frost: None ; Snow: None	Breezy, with gusting, gale force winds in exposed areas. Four large conifers blown down on site, three on the main site.	LD
25/03/2018	Winter Walkover Survey	South/West	03:07 starting at 14:45	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	Gentle Breeze. Plenty of birds in song	LD
16/10/2018	Winter Walkover Survey	WW1	01:00 starting at 14:00	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
16/10/2018	Winter Walkover Survey	WW1	01:00 starting at 15:00	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
16/10/2018	Winter Walkover Survey	WW1	01:00 starting at 16:00	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/10/2018	Winter Walkover Survey	WW2	01:00 starting at 14:00	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/10/2018	Winter Walkover Survey	WW2	01:00 starting at 15:00	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	Transect/ Survey Area	Survey Duration	Weather Conditions	Comments	Surveyor
17/10/2018	Winter Walkover Survey	WW2	01:00 starting at 16:00	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
17/12/2018	Winter Walkover Survey	1	04:00 starting at 10:30	Wind Speed and Direction:Strong Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None		JK
08/01/2019	Winter Walkover Survey		05:00 starting at 10:00	Wind Speed and Direction:Light Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		JK
22/03/2019	Winter Walkover Survey	1	03:30 starting at 13:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 60-100 Rain: None; Frost: None ; Snow: None		JK

Table 1-8 Boleybaun Surveys (VP2 Survey Effort)

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
28/09/2017	Vantage Point Survey	2	01:00 starting at 13:50	Wind Speed and Direction:Gentle Breeze, SE; Visibility: ; Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Light rain on and off throughout the survey, sometimes prolonged.	LD
28/09/2017	Vantage Point Survey	2	02:00 starting at 14:50	Wind Speed and Direction:Moderate Breeze, SE; Visibility: ; Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain on and off throughout the survey, sometimes prolonged.	LD
28/09/2017	Vantage Point Survey	2	01:00 starting at 17:20	Wind Speed and Direction:Moderate Breeze, SE; Visibility: ; Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Light rain on and off throughout the survey, sometimes prolonged.	LD
28/09/2017	Vantage Point Survey	2	01:00 starting at 18:20	Wind Speed and Direction:Moderate Breeze, SE; Visibility: ; Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain on and off throughout the survey, sometimes prolonged.	LD
28/09/2017	Vantage Point Survey	2	01:00 starting at 19:20	Wind Speed and Direction:Moderate Breeze, SE; Visibility: ; Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Light rain on and off throughout the survey, sometimes prolonged.	LD
27/10/2017	Vantage Point Survey	2	06:30 starting at 12:39	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		CP
14/11/2017	Vantage Point Survey	2	01:00 starting at 14:35	Wind Speed and Direction:Light Breeze, W; Visibility: Moderate (1-2km); Cloud Height: <150m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Light rian and heavy fog prevented the first session of the VP survey this morning. Brightened up later, although still a little misty at times during the first hour.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
14/11/2017	Vantage Point Survey	2	02:00 starting at 15:35	Wind Speed and Direction:Light Breeze, W; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Light rian and heavy fog prevented the first session of the VP survey this morning. Brightened up later, although still a little misty at times during the first hour.	LD
21/11/2017	Vantage Point Survey	2	01:00 starting at 10:55	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Continued from 14/11/17. Breezy and very quiet.	LD
21/11/2017	Vantage Point Survey	2	01:00 starting at 11:55	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: None	Continued from 14/11/17. Breezy and very quiet.	LD
21/11/2017	Vantage Point Survey	2	01:00 starting at 12:55	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	Continued from 14/11/17. Breezy and very quiet.	LD
14/12/2017	Vantage Point Survey	2	01:00 starting at 07:45	Wind Speed and Direction:Fresh Breeze, w; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: Ground		DM
14/12/2017	Vantage Point Survey	2	02:00 starting at 08:45	Wind Speed and Direction:Fresh Breeze, w; Visibility: Moderate (1-2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: Ground		DM
14/12/2017	Vantage Point Survey	2	01:00 starting at 11:15	Wind Speed and Direction:Moderate Breeze, w; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: Ground		DM

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
14/12/2017	Vantage Point Survey	2	01:00 starting at 12:15	Wind Speed and Direction:Gentle Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: Light Showers; Frost: None ; Snow: Ground		DM
14/12/2017	Vantage Point Survey	2	01:00 starting at 13:15	Wind Speed and Direction:Gentle Breeze, nw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: Ground		DM
19/01/2018	Vantage Point Survey	2	01:00 starting at 11:17	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: Heavy; Snow: Ground	Deep snow on site. Winds increasing steadily, and with it heavy snowfall during the third hour. Survey abandoned due to the heavy snow and poor visibilty.	LD
19/01/2018	Vantage Point Survey	2	01:00 starting at 12:17	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: Heavy; Snow: Ground	Deep snow on site. Winds increasing steadily, and with it heavy snowfall during the third hour. Survey abandoned due to the heavy snow and poor visibilty.	LD
19/01/2018	Vantage Point Survey	2	01:00 starting at 13:17	Wind Speed and Direction:Strong Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: Heavy; Snow: Ground	Deep snow on site. Winds increasing steadily, and with it heavy snowfall during the third hour. Survey abandoned due to the heavy snow and poor visibilty.	LD
22/01/2018	Vantage Point Survey	2	01:00 starting at 14:52	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: Ground	Still some snow on site, but much milder. Winds increasing to strong gusts, and no birds seen in the last two hours. Survey finished from 19/1/18 which was suspended due to snow.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
22/01/2018	Vantage Point Survey	2	02:00 starting at 15:52	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: Ground	Still some snow on site, but much milder. Winds increasing to strong gusts, and no birds seen in the last two hours. Survey finished from 19/1/18 which was suspended due to snow.	LD
22/02/2018	Vantage Point Survey	2	03:00 starting at 12:24	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	Ringtail HH sighted	RW
22/02/2018	Vantage Point Survey	2	03:00 starting at 15:54	Wind Speed and Direction:Gentle Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		RW
01/03/2018	Vantage Point Survey	2	1:02 starting at 12:39	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: Heavy; Snow: All Day	Snow and ice on site, with a bitterly cold breeze. Instructed by my Line Manager to abandon the survey due to a sever weather warning.	LD
09/03/2018	Vantage Point Survey	2	01:000 starting at 13:55	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None; Snow: Ground	Cold breeze, and still a smattering of snow on site. Few birds in flight all day. Completed from 1/3/2018.	LD
09/03/2018	Vantage Point Survey	2	01:00 starting at 16:25	Wind Speed and Direction:Gentle Breeze, NE; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None; Snow: Ground	Cold breeze, and still a smattering of snow on site. Few birds in flight all day. Completed from 1/3/2018.	LD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
09/03/2018	Vantage Point Survey	2	02:00 starting at 17:25	Wind Speed and Direction:Gentle Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None; Snow: Ground	Cold breeze, and still a smattering of snow on site. Few birds in flight all day. Completed from 1/3/2018.	LD
05/04/2018	Vantage Point Survey	2	06:45 starting at 07:12	Wind Speed and Direction:Light Air, ESE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0 Rain: None; Frost: None ; Snow: None		SF
04/05/2018	Vantage Point Survey	2	06:30 starting at 05:00	Wind Speed and Direction:Light Air, SSW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None	LOW CLOUD 278M VIS=2KM, CLEARING LATER	SHAY FENNELLY
26/06/2018	Vantage Point Survey	2	03:00 starting at 14:40	Wind Speed and Direction:Light Air, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None; Snow: None	No sightings	RW
26/06/2018	Vantage Point Survey	2	03:00 starting at 18:10	Wind Speed and Direction:Light Air, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None; Snow: None	No sightings	RW
13/07/2018	Vantage Point Survey	2	03:00 starting at 09:17	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	No sightings	RW
13/07/2018	Vantage Point Survey	2	03:00 starting at 12:47	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	No sightings	RW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
14/08/2018	Vantage Point Survey	2	01:00 starting at 08:00	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: ; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
14/08/2018	Vantage Point Survey	2	01:00 starting at 09:00	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Light Showers; Frost: None; Snow: None		DM
14/08/2018	Vantage Point Survey	2	01:00 starting at 10:00	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: Drizzle Mist; Frost: None; Snow: None		DM
14/08/2018	Vantage Point Survey	2	03:00 starting at 11:30	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
19/09/2018	Vantage Point Survey	2	03:00 starting at 13:00	Wind Speed and Direction:Strong Breeze, w; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM
20/09/2018	Vantage Point Survey	2	02:00 starting at 06:15	Wind Speed and Direction:Gentle Breeze, sw; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66% Rain: None; Frost: None; Snow: None		DM
20/09/2018	Vantage Point Survey	2	01:00 starting at 08:15	Wind Speed and Direction:Moderate Breeze, sw; Visibility: Good (>2km); Cloud Height: ; Cloud Cover %: 66-100% Rain: None; Frost: None; Snow: None		DM

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
19/10/2018	Vantage Point Survey	2	01:00 starting at 13:30	Wind Speed and Direction:Calm, W; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
19/10/2018	Vantage Point Survey	2	01:00 starting at 14:30	Wind Speed and Direction:Calm, W; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
19/10/2018	Vantage Point Survey	2	01:00 starting at 15:30	Wind Speed and Direction:Calm, W; Visibility: Limited (<500m); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
22/10/2018	Vantage Point Survey	2	01:00 starting at 16:15	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
22/10/2018	Vantage Point Survey	2	01:00 starting at 17:15	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
22/10/2018	Vantage Point Survey	2	01:00 starting at 18:15	Wind Speed and Direction:Gentle Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
07/11/2018	Vantage Point Survey	2	02:00 starting at 06:44	Wind Speed and Direction:Light Air, NE; Visibility: No Visibility; Cloud Height: <150m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		J.Kennedy

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
08/11/2018	Vantage Point Survey	2	04:00 starting at 08:44	Wind Speed and Direction:Fresh Breeze, SE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: <10 Rain: None; Frost: None ; Snow: None		J.Kennedy
11/12/2018	Vantage Point Survey	2	06:00 starting at 07:40	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 100 Rain: Drizzle Mist; Frost: None ; Snow: None		JK
01/02/2019	Vantage Point Survey	2	06:30 starting at 11:30	Wind Speed and Direction:Light Air, NE; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: Ground	JANUARY SURVEY	JK
12/02/2019	Vantage Point Survey	2	02:00 starting at 12:07	Wind Speed and Direction:Strong Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A fresh to sttrong breeze on the survey site and therefore very quiet throught the three hours.	L. Dark
12/02/2019	Vantage Point Survey	2	01:00 starting at 14:07	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 2 Rain: None; Frost: None ; Snow: None	A fresh to sttrong breeze on the survey site and therefore very quiet throught the three hours.	L. Dark
18/02/2019	Vantage Point Survey	2	02:00 starting at 15:46	Wind Speed and Direction:Fresh Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: None; Frost: None ; Snow: None	A cool, fresh breeze on site and quite quiet again, with only a few Passerine's in flight, or song.	L. Dark
18/02/2019	Vantage Point Survey	2	01:00 starting at 17:46	Wind Speed and Direction:Moderate Breeze, SW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: None	A cool, fresh breeze on site and quite quiet again, with only a few Passerine's in flight, or song.	L. Dark

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
11/03/2019	Vantage Point Survey	2	03:00 starting at 07:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: None; Frost: None ; Snow: None	No sightings	RW
11/03/2019	Vantage Point Survey	2	03:00 starting at 10:30	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 100 Rain: Light Showers; Frost: None ; Snow: None	Light rain in 3rd hour. No sightings	RW
02/04/2019	Vantage Point Survey	2	01:00 starting at 14:40	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: All Day	Very cold day, with sub-zero temperatures and regular heavy snow showers. Few birds seen in flight throughout the survey.	L. Dark
02/04/2019	Vantage Point Survey	2	02:00 starting at 15:40	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: All Day	Very cold day, with sub-zero temperatures and regular heavy snow showers. Few birds seen in flight throughout the survey.	L. Dark
02/04/2019	Vantage Point Survey	2	03:00 starting at 18:10	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 3 Rain: Heavy Showers; Frost: None ; Snow: All Day	Very cold day, with sub-zero temperatures and regular heavy snow showers. Few birds seen in flight throughout the survey.	L. Dark
17/05/2019	Vantage Point Survey	2	01:00 starting at 04:30	Wind Speed and Direction:Light Air, S ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD
17/05/2019	Vantage Point Survey	2	01:00 starting at 05:30	Wind Speed and Direction:Light Air, S ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 0-33 Rain: None; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
17/05/2019	Vantage Point Survey	2	01:00 starting at 06:30	Wind Speed and Direction:Light Air, S ; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/05/2019	Vantage Point Survey	2	01:00 starting at 08:00	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None		AOD
17/05/2019	Vantage Point Survey	2	01:00 starting at 09:00	Wind Speed and Direction:Light Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
17/05/2019	Vantage Point Survey	2	01:00 starting at 10:00	Wind Speed and Direction:Gentle Breeze, S; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD
12/06/2019	Vantage Point Survey	2	02:00 starting at 14:00	Wind Speed and Direction:Moderate Breeze, N; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		PW
12/06/2019	Vantage Point Survey	2	01:12 starting at 16:00	Wind Speed and Direction:Gentle Breeze, N; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 33-66 Rain: None; Frost: None ; Snow: None	14:50-15:15, Car arrived up lane and 2 men and a dog began working some turf between VP2 and the site, within the 500m buffer.	PW
12/06/2019	Vantage Point Survey	2	01:00 starting at 17:44	Wind Speed and Direction:Gentle Breeze, N; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	18:25, Van comes up track behind VP 2 to work turf.	PW

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
12/06/2019	Vantage Point Survey	2	01:00 starting at 18:44	Wind Speed and Direction:Moderate Breeze, N; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	19:00, Van leaves and another man comes up in front of VP2 on quad to work turf. 19:09 man on quad leaves turf.	PW
12/06/2019	Vantage Point Survey	2	00:48 starting at 19:44	Wind Speed and Direction:Moderate Breeze, N; Visibility: Good (>2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None	20:15, a couple people walk up track toward VP2 and then turn back around.	PW
10/07/2019	Vantage Point Survey	2	06:30 starting at 13:00	Wind Speed and Direction:Light Breeze, SW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 60-100 Rain: Heavy Showers; Frost: None ; Snow: None		
03/09/2019	Vantage Point Survey	2	01:00 starting at 05:45	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
03/09/2019	Vantage Point Survey	2	01:00 starting at 06:45	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Poor (<km); Cloud Height: <150m; Cloud Cover %: 66-100 Rain: Heavy Showers; Frost: None ; Snow: None		AOD
03/09/2019	Vantage Point Survey	2	01:00 starting at 07:45	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Moderate (1-2km); Cloud Height: 150-500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
03/09/2019	Vantage Point Survey	2	01:00 starting at 09:15	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD

Date	Survey Method	VP	Survey Duration	Weather Conditions	Comments	Surveyor
03/09/2019	Vantage Point Survey	2	01:00 starting at 10:15	Wind Speed and Direction:Moderate Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: Drizzle Mist; Frost: None ; Snow: None		AOD
03/09/2019	Vantage Point Survey	2	01:00 starting at 11:15	Wind Speed and Direction:Fresh Breeze, NW; Visibility: Good (>2km); Cloud Height: >500m; Cloud Cover %: 66-100 Rain: None; Frost: None ; Snow: None		AOD

Table of Contents

TABLE OF TABLES

Table 1-1 Vantage Point Survey Effort Summary 2
Table 1-2 Monthly distribution of flight activity for target species during VP Surveys. 3
Table 1-3 All observations within focus area at PCH for target species during vantage point watches. 6
Table 1-4 Monthly Distribution of Non-Target Species during Vantage Point Surveys 7
Table 1-5 Monthly distribution of target species during Breeding Bird (Adapted Brown & Shephard) Surveys. 12
Table 1-6 Monthly Distribution of Non-Target Species during Breeding Bird Surveys. 14
Table 1-7 Monthly distribution of observations during Breeding Raptor Surveys 17
Table 1-8 Monthly distribution for target species during Winter Transect Surveys. 18
Table 1-9 Monthly Distribution of Non-Target Species during Winter Transect Surveys 19

1. APPENDIX 7-3 (SUMMARY TABLES)

Table 1-1 Vantage Point Survey Effort Summary

Survey Season	Months	Minimum Effort per VP
2017/2018 Non-Breeding Season (4VPs)	Sep - Mar	42 hours/VP
2018 Breeding Season (4VPs)	Apr - Sep	36 hours/VP
2018/2019 Non-Breeding Season (4VPs)	Oct - Mar	36 hours/VP
2019 Breeding Season (4VPs)	Apr - Sep	36 hours/VP

Table 1-2 Monthly distribution of flight activity for target species during VP Surveys.

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Whooper Swan	2017	records													**0**
		bird-secs													**0**
	2018	records										2		1	**3**
		bird-secs										180		40	**220**
	2019	records			1										**1**
		bird-secs			20										**20**
Golden Plover	2017	records										1		3	**4**
		bird-secs										22		210	**232**
	2018	records		1								8	7	2	**18**
		bird-secs		35								1,305	1,545	296	**3,181**
	2019	records	3	2	1										**6**
		bird-secs	14	57	104										**175**
Hen Harrier	2017	records													**0**
		bird-secs													**0**
	2018	records				1		1		4				1	**7**
		bird-secs				15		10		280				25	**330**
	2019	records								1					**1**
		bird-secs								25					**25**
Merlin	2017	records													**0**
		bird-secs													**0**
	2018	records									1				**1**
		bird-secs									35				**35**
	2019	records													**0**
		bird-secs													**0**
Red Grouse	2017	records												1	**1**
		bird-secs												20	**20**
	2018	records					1								**1**

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
		bird-secs					15								**15**
	2019	records	1								2				**3**
		bird-secs	6								8				**14**
Woodcock	2017	records													**0**
		bird-secs													**0**
	2018	records													**0**
		bird-secs													**0**
	2019	records				1									**1**
		bird-secs				8									**8**
Curlew	2017	records													**0**
		bird-secs													**0**
	2018	records				1									**1**
		bird-secs				10									**10**
	2019	records													**0**
		bird-secs													**0**
Buzzard	2017	records										1			**1**
		bird-secs										47			**47**
	2018	records		1		3							1		**5**
		bird-secs		384		470							400		**1,254**
	2019	records			2			2							**4**
		bird-secs			229			20							**249**
Sparrowhawk	2017	records													**0**
		bird-secs													**0**
	2018	records								1		1			**2**
		bird-secs								10		40			**50**
	2019	records						1							**1**
		bird-secs						118							**118**

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Kestrel	2017	records													**0**
		bird-secs													**0**
	2018	records				1		9	2	1			1		**14**
		bird-secs				130		1,193	301	225			300		**2,149**
	2019	records			1				1		1				**3**
		bird-secs			176				360		18				**554**
Snipe	2017	records												1	**1**
		bird-secs												30	**30**
	2018	records									2	1			**3**
		bird-secs									100	3			**103**
	2019	records				2	2	3							**7**
		bird-secs				1810	670	877							**3,357**

Based on analysis of all flight activity data within focus area, including data from VPs 1, 3 & 4 and observations of flights below and above the collision risk height band. Survey period = September 2017 - September 2019 (Shaded Cells were months not surveyed). Records = No. of Observations. Bird-secs = Total Duration of Flight(s).

Table 1-3 All observations within focus area at PCH for target species during vantage point watches

Species	Values	VP1	VP3	VP4	Totals
Whooper Swan	Obervations (All Bands)	2	1	1	4
	Duration in PCH (25-175m, in Seconds)	5,768	0	400	6,168
Golden Plover	Obervations (All Bands)	18	10	0	28
	Duration in PCH (25-175m, in Seconds)	194,626	93,726	0	288,352
Hen Harrier	Obervations (All Bands)	4	3	1	8
	Duration in PCH (25-175m, in Seconds)	40	25	0	65
Merlin	Obervations (All Bands)	0	1	0	1
	Duration in PCH (25-175m, in Seconds)	0	15	0	15
Red Grouse	Obervations (All Bands)	3	2	0	5
	Duration in PCH (25-175m, in Seconds)	0	0	0	0
Woodcock	Obervations (All Bands)	0	1	0	1
	Duration in PCH (25-175m, in Seconds)	0	0	0	0
Curlew	Obervations (All Bands)	0	0	1	1
	Duration in PCH (25-175m, in Seconds)	0	0	0	0
Buzzard	Obervations (All Bands)	3	4	3	10
	Duration in PCH (25-175m, in Seconds)	447	554	400	1,401
Sparrowhawk	Obervations (All Bands)	1	0	2	3
	Duration in PCH (25-175m, in Seconds)	0	0	110	110
Kestrel	Obervations (All Bands)	1	13	3	17
	Duration in PCH (25-175m, in Seconds)	0	604	104	708
Snipe	Obervations (All Bands)	9	2	0	11
	Duration in PCH (25-175m, in Seconds)	983	190	0	1,173

Based on analysis of all flight data at PCH for each target species recorded between September 2017 and September 2019. Any non-flight observations were excluded from data analysis. PCH=(no. of birds x total duration in PCH). PCH (Potential Collision Height) is considered as the area between 25-175m as a worst-case scenario for swept height of the turbine blades.

Table 1-4 Monthly Distribution of Non-Target Species during Vantage Point Surveys

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Common Gull	2017	Present = X												
	2018	Present = X												
	2019	Present = X					X							
Grey Heron	2017	Present = X												
	2018	Present = X												
	2019	Present = X						X						
Kittiwake	2017	Present = X												
	2018	Present = X												
	2019	Present = X			X									
Lesser Black-backed Gull	2017	Present = X												
	2018	Present = X				X								
	2019	Present = X												
Mallard	2017	Present = X												
	2018	Present = X				X	X							
	2019	Present = X				X								
Blackbird	2017	Present = X												
	2018	Present = X	X		X	X	X			X		X	X	X
	2019	Present = X		X			X							
Blue Tit	2017	Present = X									X			X
	2018	Present = X			X								X	X
	2019	Present = X												
Bullfinch	2017	Present = X												X
	2018	Present = X												
	2019	Present = X												
Carrion Crow	2017	Present = X									X		X	
	2018	Present = X												
	2019	Present = X												

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chaffinch	2017	Present = X									X			
	2018	Present = X		X			X					X	X	
	2019	Present = X				X				X				
Chiffchaff	2017	Present = X												
	2018	Present = X												
	2019	Present = X				X					X			
Coal Tit	2017	Present = X												X
	2018	Present = X	X							X	X	X	X	X
	2019	Present = X				X					X			
Collared Dove	2017	Present = X												
	2018	Present = X			X									
	2019	Present = X												
Crossbill	2017	Present = X										X		
	2018	Present = X		X	X									
	2019	Present = X				X								
Cuckoo	2017	Present = X												
	2018	Present = X				X	X							
	2019	Present = X				X	X	X	X					
Dunnock	2017	Present = X												
	2018	Present = X									X		X	X
	2019	Present = X		X		X				X				
Fieldfare	2017	Present = X												X
	2018	Present = X										X	X	
	2019	Present = X												
Goldcrest	2017	Present = X												
	2018	Present = X										X		
	2019	Present = X												

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Goldfinch	2017	Present = X												
	2018	Present = X									X			
	2019	Present = X									X			
Great Tit	2017	Present = X												
	2018	Present = X									X	X		
	2019	Present = X				X	X			X				
Grey Wagtail	2017	Present = X												
	2018	Present = X								X				
	2019	Present = X									X			
Hooded Crow	2017	Present = X										X	X	X
	2018	Present = X	X	X	X	X	X			X	X	X	X	X
	2019	Present = X	X	X		X	X		X		X			
Jay	2017	Present = X												X
	2018	Present = X	X							X				
	2019	Present = X		X					X		X			
Lesser Redpoll	2017	Present = X									X	X		X
	2018	Present = X								X	X			
	2019	Present = X		X		X	X	X	X					
Linnet	2017	Present = X									X		X	
	2018	Present = X		X	X									
	2019	Present = X				X								
Magpie	2017	Present = X												
	2018	Present = X		X										
	2019	Present = X				X	X							
Meadow Pipit	2017	Present = X									X	X	X	
	2018	Present = X	X	X	X	X	X			X	X		X	X
	2019	Present = X		X		X	X	X	X	X	X			

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mistle Thrush	2017	Present = X										X		
	2018	Present = X			X		X			X	X	X		X
	2019	Present = X		X		X	X	X		X	X			
Wheatear	2017	Present = X												
	2018	Present = X				X					X			
	2019	Present = X				X					X			
Pheasant	2017	Present = X												
	2018	Present = X				X	X			X	X			
	2019	Present = X						X						
Pied Wagtail	2017	Present = X												
	2018	Present = X									X			
	2019	Present = X												
Raven	2017	Present = X										X	X	X
	2018	Present = X	X	X	X	X	X			X	X	X	X	X
	2019	Present = X	X	X		X	X	X		X	X			
Redwing	2017	Present = X										X		
	2018	Present = X										X	X	
	2019	Present = X												
Reed Bunting	2017	Present = X												
	2018	Present = X			X						X			
	2019	Present = X									X			
Robin	2017	Present = X												X
	2018	Present = X	X	X	X	X	X				X	X	X	X
	2019	Present = X		X		X	X				X			
Siskin	2017	Present = X										X		
	2018	Present = X												
	2019	Present = X		X		X		X	X	X				

Species	Year	Standardised	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Skylark	2017	Present = X												
	2018	Present = X				X	X				X			
	2019	Present = X				X	X				X			
Song Thrush	2017	Present = X									X			
	2018	Present = X			X	X								
	2019	Present = X		X		X	X							
Stonechat	2017	Present = X									X		X	
	2018	Present = X		X		X	X			X	X	X	X	X
	2019	Present = X				X	X	X	X		X			
Swallow	2017	Present = X												
	2018	Present = X				X	X			X	X			
	2019	Present = X							X		X			
Swift	2017	Present = X												
	2018	Present = X												
	2019	Present = X						X						
Whitethroat	2017	Present = X												
	2018	Present = X												
	2019	Present = X							X					
Willow Warbler	2017	Present = X												
	2018	Present = X					X							
	2019	Present = X				X								
Wood Pigeon	2017	Present = X												X
	2018	Present = X					X			X				
	2019	Present = X				X	X		X					
Wren	2017	Present = X									X		X	X
	2018	Present = X	X	X	X	X				X	X	X	X	
	2019	Present = X		X		X	X		X	X	X			

Based on analysis of all flight activity data within focus area, including data from VPs 1, 3 & 4. Survey period = September 2017 - September 2019 (Shaded Cells were months not surveyed).

Table 1-5 Monthly distribution of target species during Breeding Bird (Adapted Brown & Shephard) Surveys.

Species	Year	Standardised	Apr	May	Jun	Jul	Totals
Hen Harrier	2018	No. of observations					0
		No. of individuals					0
	2019	No. of observations			1		1
		No. of individuals			1		1
Merlin	2018	No. of observations		1			1
		No. of individuals		1			1
	2019	No. of observations					0
		No. of individuals					0
Red Grouse	2018	No. of observations				1	1
		No. of individuals				1	1
	2019	No. of observations			1		1
		No. of individuals			1		1
Buzzard	2018	No. of observations					0
		No. of individuals					0
	2019	No. of observations	1		1		2
		No. of individuals	1		1		2
Sparrowhawk	2018	No. of observations					0
		No. of individuals					0
	2019	No. of observations	1		1		2
		No. of individuals	1		1		2

Species	Year	Standardised	Apr	May	Jun	Jul	Totals
Kestrel	2018	No. of observations		1		1	**2**
		No. of individuals		1		1	**2**
	2019	No. of observations	1			4	**5**
		No. of individuals	1			4	**5**
Snipe	2018	No. of observations	3			2	**5**
		No. of individuals	4			2	**6**
	2019	No. of observations		2	1	1	**4**
		No. of individuals		2	1	1	**4**

Table 1-6 Monthly Distribution of Non-Target Species during Breeding Bird Surveys

Species	Year	Standardised	Apr	May	Jun	Jul
Blackbird	2018	Present = X	X	X		
	2019	Present = X				X
Blue Tit	2018	Present = X	X			
	2019	Present = X				X
Bullfinch	2018	Present = X				
	2019	Present = X				X
Chaffinch	2018	Present = X	X	X	X	
	2019	Present = X				X
Chiffchaff	2018	Present = X	X			
	2019	Present = X				
Coal Tit	2018	Present = X	X	X	X	
	2019	Present = X				
Crossbill	2018	Present = X	X			
	2019	Present = X				
Cuckoo	2018	Present = X	X	X	X	
	2019	Present = X				
Dunnock	2018	Present = X	X	X	X	
	2019	Present = X				X
Goldcrest	2018	Present = X	X		X	
	2019	Present = X				X
Great Black-backed Gull	2018	Present = X			X	
	2019	Present = X				
Grey Heron	2018	Present = X	X			
	2019	Present = X		X		

Species	Year	Standardised	Apr	May	Jun	Jul
Grey Wagtail	2018	Present = X			X	
	2019	Present = X			X	
Hooded Crow	2018	Present = X	X	X	X	
	2019	Present = X				X
House Martin	2018	Present = X	X			
	2019	Present = X				
Lesser Black-backed Gull	2018	Present = X				
	2019	Present = X			X	
Lesser Redpoll	2018	Present = X		X	X	
	2019	Present = X				X
Linnet	2018	Present = X	X	X		
	2019	Present = X				
Mallard	2018	Present = X	X	X		
	2019	Present = X	X			
Marsh Tit	2018	Present = X	X	X	X	
	2019	Present = X				
Meadow Pipit	2018	Present = X	X	X		
	2019	Present = X			X	X
Raven	2018	Present = X	X			
	2019	Present = X				X
Reed Bunting	2018	Present = X	X	X	X	
	2019	Present = X				
Robin	2018	Present = X	X	X	X	
	2019	Present = X				

Species	Year	Standardised	Apr	May	Jun	Jul
Siskin	2018	Present = X	X	X	X	
	2019	Present = X				X
Skylark	2018	Present = X	X		X	
	2019	Present = X				
Stonechat	2018	Present = X				
	2019	Present = X				X
Willow Warbler	2018	Present = X	X	X	X	
	2019	Present = X				X
Wood Pigeon	2018	Present = X	X			
	2019	Present = X				
Wren	2018	Present = X	X		X	
	2019	Present = X				X

Table 1-7 Monthly distribution of observations during Breeding Raptor Surveys

Species	Year	Standardised	Apr	May	Jun	Jul	Totals
Hen Harrier	2018	No. of observations		1			**1**
		No. of individuals		1			**1**
	2019	No. of observations				1	**1**
		No. of individuals				1	**1**
Peregrine	2018	No. of observations				1	**1**
		No. of individuals				1	**1**
	2019	No. of observations					**0**
		No. of individuals					**0**
Buzzard	2018	No. of observations	1	3			**4**
		No. of individuals	1	3			**4**
	2019	No. of observations	1	3	1		**5**
		No. of individuals	2	4	1		**7**
Sparrowhawk	2018	No. of observations	2	4		3	**9**
		No. of individuals	2	4		4	**10**
	2019	No. of observations		3	1		**4**
		No. of individuals		3	1		**4**
Kestrel	2018	No. of observations	3	3	2	3	**11**
		No. of individuals	3	3	2	3	**11**
	2019	No. of observations			1	1	**2**
		No. of individuals			1	1	**2**

Table 1-8 Monthly distribution for target species during Winter Transect Surveys

Species	Year	Standardised	Jan	Mar	Oct	Dec	Totals
Golden Plover	2017	No. of observations					0
		No. of individuals					0
	2018	No. of observations			1		1
		No. of individuals			40		40
	2019	No. of observations	1				1
		No. of individuals	30				30
Kestrel	2017	No. of observations					0
		No. of individuals					0
	2018	No. of observations			1		1
		No. of individuals			1		1
	2019	No. of observations					0
		No. of individuals					0

Table 1-9 Monthly Distribution of Non-Target Species during Winter Transect Surveys

Species	Year	Standardised	Jan	Mar	Oct	Dec
Blackbird	2017	Present = X			X	
	2018	Present = X		X		
	2019	Present = X		X		
Blue Tit	2017	Present = X			X	X
	2018	Present = X	X	X		X
	2019	Present = X	X	X		
Bullfinch	2017	Present = X				X
	2018	Present = X	X			
	2019	Present = X				
Chaffinch	2017	Present = X				
	2018	Present = X		X		
	2019	Present = X		X		
Coal Tit	2017	Present = X			X	X
	2018	Present = X	X	X		X
	2019	Present = X		X		
Crossbill	2017	Present = X			X	X
	2018	Present = X	X	X		
	2019	Present = X				
Dunnock	2017	Present = X			X	X
	2018	Present = X		X		
	2019	Present = X				

Species	Year	Standardised	Jan	Mar	Oct	Dec
Fieldfare	2017	Present = X			X	
	2018	Present = X				
	2019	Present = X				
Goldcrest	2017	Present = X				
	2018	Present = X				
	2019	Present = X	X	X		
Goldfinch	2017	Present = X				
	2018	Present = X				X
	2019	Present = X	X			
Great Tit	2017	Present = X			X	
	2018	Present = X	X			
	2019	Present = X	X	X		
Hooded Crow	2017	Present = X				X
	2018	Present = X	X	X		X
	2019	Present = X				
Jay	2017	Present = X				X
	2018	Present = X	X			
	2019	Present = X				
Lesser Redpoll	2017	Present = X				X
	2018	Present = X				
	2019	Present = X	X	X		

Species	Year	Standardised	Jan	Mar	Oct	Dec
Linnet	2017	Present = X				
	2018	Present = X	X	X		X
	2019	Present = X				
Long-tailed Tit	2017	Present = X			X	X
	2018	Present = X	X			
	2019	Present = X				
Marsh Tit	2017	Present = X				
	2018	Present = X	X	X		
	2019	Present = X				
Meadow Pipit	2017	Present = X			X	X
	2018	Present = X	X	X		X
	2019	Present = X		X		
Raven	2017	Present = X			X	X
	2018	Present = X		X		X
	2019	Present = X	X			
Redwing	2017	Present = X			X	
	2018	Present = X				
	2019	Present = X				
Reed Bunting	2017	Present = X				X
	2018	Present = X				
	2019	Present = X				

Species	Year	Standardised	Jan	Mar	Oct	Dec
Robin	2017	Present = X			X	X
	2018	Present = X	X	X		
	2019	Present = X	X	X		
Siskin	2017	Present = X			X	
	2018	Present = X				
	2019	Present = X				
Treecreeper	2017	Present = X				
	2018	Present = X				X
	2019	Present = X	X			
Wren	2017	Present = X			X	X
	2018	Present = X	X	X		X
	2019	Present = X	X	X		

Table of Contents

TABLE OF TABLES

Table 1-1 Whooper Swan Vantage Point Survey Data 2
Table 1-2 Whooper Swan Incidental Observation during Hen Harrier Roost Survey 2
Table 1-3 Golden Plover Vantage Point Survey Flights 3
Table 1-4 Golden Plover Vantage Point Survey Non-Visual Observations 5
Table 1-5 Golden Plover Winter Transect Survey Observations 5
Table 1-6 Golden Plover Incidental Observations 6
Table 1-7 Hen Harrier Vantage Point Survey Observations 7
Table 1-8 Hen Harrier Breeding Bird Survey Observation 7
Table 1-9 Hen Harrier Breeding Raptor Survey Observations 8
Table 1-10 Hen Harrier Roost Survey Observations 8
Table 1-11 Merlin Vantage Point Survey Observations 9
Table 1-12 Peregrine Breeding Raptor Survey Observation 10
Table 1-13 Red Grouse Vantage Point Survey Flights 11
Table 1-14 Red Grouse Vantage Point Surveys Non-Visual Observations 11
Table 1-15 Red Grouse Breeding Walkover Survey Observations 12
Table 1-16 Red Grouse Tape Lure Survey Observations 13
Table 1-17 Red Grouse Winter Transect Survey Observation 13
Table 1-18 Red Grouse Incidental Observations 13
Table 1-19 Woodcock Vantage Point Survey Observation 15
Table 1-20 Breeding Woodcock Survey Observations 15
Table 1-21 Curlew Vantage Point Survey Flight 16
Table 1-22 Curlew Vantage Point Survey Non-Visual Observations 16
Table 1-23 Curlew Incidental Observations 16
Table 1-24 Buzzard Vantage Point Survey Observations 17
Table 1-25 Buzzard Breeding Walkover Survey Observation 18
Table 1-26 Buzzard Breeding Raptor Observations 18
Table 1-27 Buzzard Incidental Observation 19
Table 1-28 Sparrowhawk Vantage Point Survey Data 20
Table 1-29 Sparrowhawk Breeding Walkover Survey Data 20
Table 1-30 Sparrowhawk Breeding Raptor Survey Data 20
Table 1-31 Sparrowhawk Incidental Observations 22
Table 1-32 Kestrel Vantage Point Survey Data 23
Table 1-33 Kestrel Breeding Bird Survey Observations 24
Table 1-34 Kestrel Breeding Raptor Survey Observations 25
Table 1-35 kestrel Incidental Observations 26

Table 1-36 Snipe Vantage Point Survey Flights 28
Table 1-37 Snipe Vantage Point Survey Non-Visual Observations 29
Table 1-38 Snipe Breeding Bird Survey Observations 30
Table 1-39 Snipe Incidental Observations 30

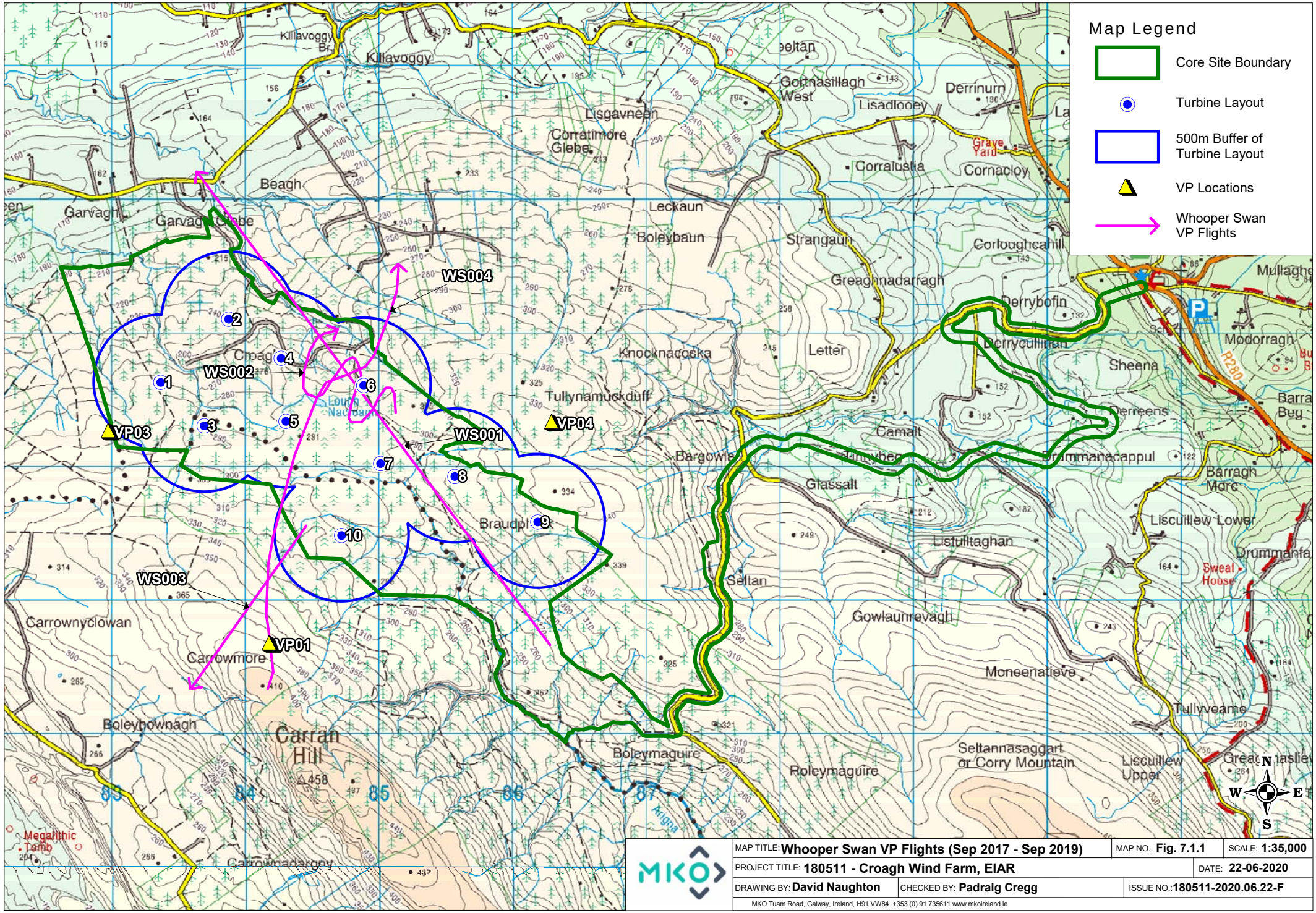
1. APPENDIX 7-4 (SURVEY DATA)

Table 1-1 Whooper Swan Vantage Point Survey Data

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
WS001	18/10/2018	4	Whooper Swan	4	18:31:00	100	80	20			100		WD4, (Conifer plantation) PB2, (Upland blanket bog) Migrating	Calling	AOD
WS002	26/10/2018	3	Whooper Swan	10	15:55:00	80	40	40				80	WD4, (Conifer plantation) PB2, (Upland blanket bog) Migrating flock calling		AOD
WS003	03/12/2018	1	Whooper Swan	4	11:40:00	40	6	34		13	27		WD4, (Conifer plantation) PB2, (Upland blanket bog) Travelling		JK
WS004	26/03/2019	1	Whooper Swan	20	10:41:00	283			0	0	283	0	PB2, (Upland blanket bog) WD4, (Conifer plantation) Migrating flock passed by VP at 30m, increasing in height with the change in ground contours over forestry before increasing in altitude, to 100m approx.	migrating flock	RW

Table 1-2 Whooper Swan Incidental Observation during Hen Harrier Roost Survey

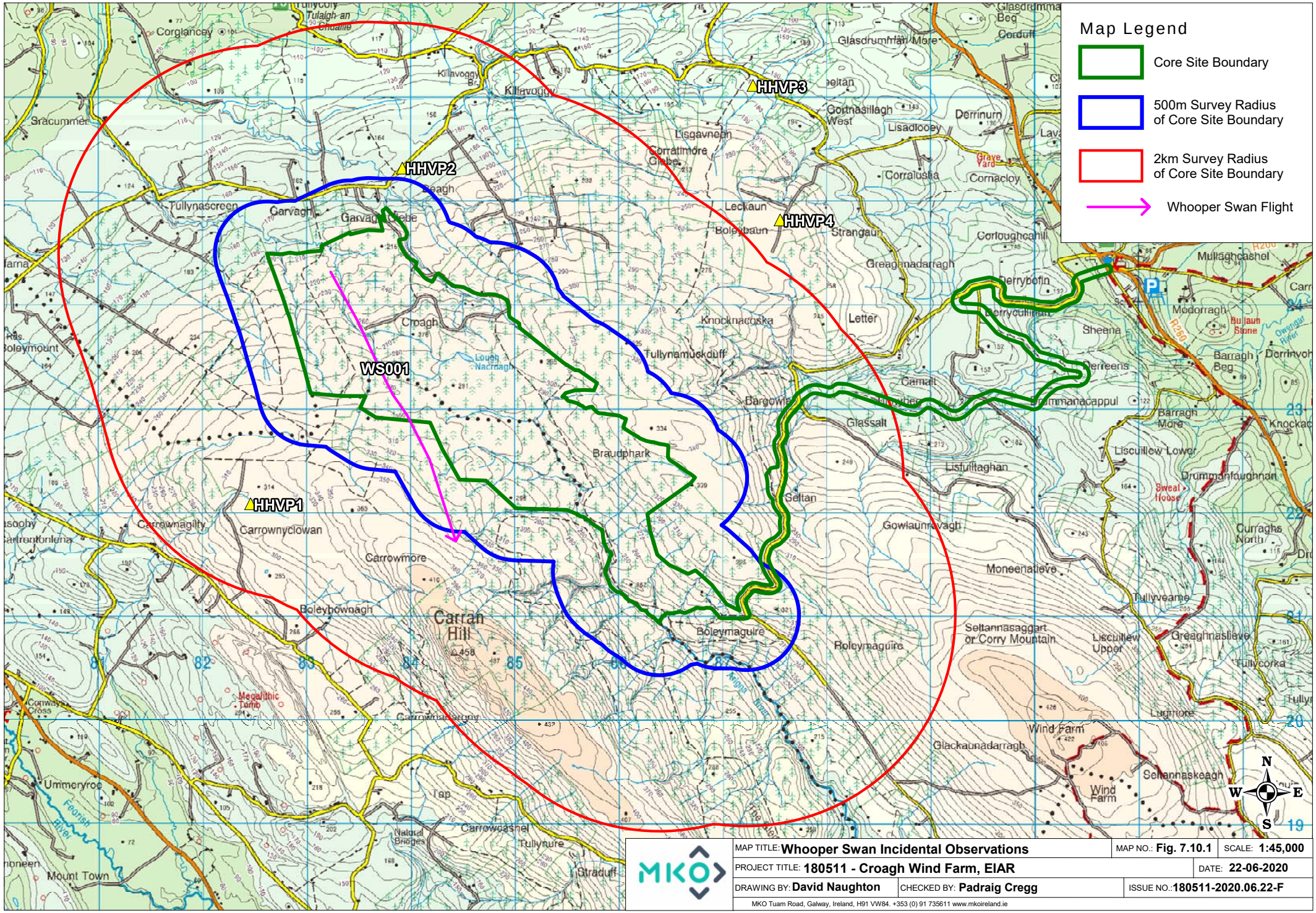
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
WS001	26/10/2018	Hen Harrier Roost Survey	HHVP1	Whooper Swan	23	Flock of 23 flew over site migrating north to south band 3 100s	AOD



MAP TITLE: **Whooper Swan VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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MAP TITLE: **Whooper Swan Incidental Observations**		MAP NO.: **Fig. 7.10.1**	SCALE: **1:45,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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Table 1-3 Golden Plover Vantage Point Survey Flights

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
GP001	25/10/2017	1	Golden Plover	34	18:06:00	22				22				F; u/w	CP
GP002	20/12/2017	1	Golden Plover	5	09:15:00	20			20				PB2, (Upland blanket bog) flushed from heath		DM
GP003	20/12/2017	1	Golden Plover	37	13:30:00	170					70	100	PB2, (Upland blanket bog) WD4, (Conifer plantation) circling and travelling		DM
GP004	20/12/2017	1	Golden Plover	5	13:40:00	20			20				PB2, (Upland blanket bog) flushed and re-landed on heath		DM
GP005	24/02/2018	1	Golden Plover	16	12:51:00	35			3	11	21		PB2, (Upland blanket bog) PB4, (Cutover bog) Flew W around VP location from 5-30m	Non-breeding flock	RW
GP006	23/10/2018	1	Golden Plover	33	13:05:00	45		45		45			GS4, (Wet grassland) Calling flock near VP		AOD
GP007	23/10/2018	1	Golden Plover	110	13:39:00	200	150	50		100	100		WD4, (Conifer plantation) Flying flock		AOD
GP008	23/10/2018	1	Golden Plover	190	15:35:00	40	40			30	160		WD4, (Conifer plantation) Flying Flock		AOD
GP009	23/10/2018	1	Golden Plover	5	16:39:00	5		5	5				WD4, (Conifer plantation) Flock near VP calling		AOD
GP0010	23/10/2018	1	Golden Plover	270	17:26:00	600	450	150		50	350	200	WD4, (Conifer plantation) PB2, (Upland blanket bog) GS4, (Wet grassland) Largest flock seen flying		AOD
GP0011	23/10/2018	1	Golden Plover	150	17:39:00	350	250	100			350		WD4, (Conifer plantation) PB2, (Upland blanket bog) GS4, (Wet grassland) Flying flock		AOD
GP0012	23/10/2018	1	Golden Plover	12	17:39:00	30		30		30			WD4, (Conifer plantation) PB2, (Upland blanket bog) GS4, (Wet grassland) Flying flock		AOD

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
GP0013	26/10/2018	3	Golden Plover	109	16:09:00	35	35	0				35	WD4, (Conifer plantation) PB2, (Upland blanket bog) Flying flock		AOD
GP0015	30/11/2018	3	Golden Plover	2	09:33:00	22							PB4, (Cutover bog) Pair flying low over heather		JK
GP0016	30/11/2018	3	Golden Plover	9	09:51:00	120					120		PB4, (Cutover bog) WD4, (Conifer plantation) Small flock crossing site		JK
GP0017	30/11/2018	3	Golden Plover	250	09:51:00	780					180	600	PB4, (Cutover bog) WD4, (Conifer plantation) Large flock circling over site	Large flock circling over site in murmeration for extended time, before heading SE.	JK
GP0018	30/11/2018	3	Golden Plover	90	10:04:00	480				60	360	60	PB4, (Cutover bog) WD4, (Conifer plantation)		JK
GP0019	30/11/2018	3	Golden Plover	50	10:45:00	56					56		PB4, (Cutover bog) WD4, (Conifer plantation)		JK
GP0020	30/11/2018	3	Golden Plover	95	10:52:00	67					58	9	PB4, (Cutover bog) WD4, (Conifer plantation)		JK
GP0021	30/11/2018	3	Golden Plover	120	11:10:00	20					20		PB4, (Cutover bog) WD4, (Conifer plantation)		JK
GP0022	03/12/2018	1	Golden Plover	15	07:51:00	26	26		26				PB2, (Upland blanket bog) Flushed from heather		JK
GP0023	05/12/2018	3	Golden Plover	15	09:46:00	282	270	12	18	4	136	124	WD4, (Conifer plantation) PB4, (Cutover bog) Circling over site		JK
GP0024	15/01/2019	1	Golden Plover	2	13:15:00	3	3		3				PB4, (Cutover bog) Flying low over cutover		JK
GP0025	15/01/2019	1	Golden Plover	25	13:57:00	8	8		8				PB4, (Cutover bog) Flying low over cutover		JK
GP0026	15/01/2019	1	Golden Plover	2	16:53:00	3	3		3				PB4, (Cutover bog) Flying low over cutover		JK

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
GP0027	07/02/2019	1	Golden Plover	110	14:28:00	35				2	30	3	PB4, (Cutover bog) Travelling		JK
GP0028	07/02/2019	1	Golden Plover	120	14:29:00	22						22	WD4, (Conifer plantation) PB4, (Cutover bog) Travelling		JK
GP0029	14/03/2019	3	Golden Plover	24	09:41:00	104			0	0	104	0	PB2, (Upland blanket bog) Flew in from the W at 60-70m, circled several times then moved back W beyond VP	Non-breeding flock	RW

Table 1-4 Golden Plover Vantage Point Survey Non-Visual Observations

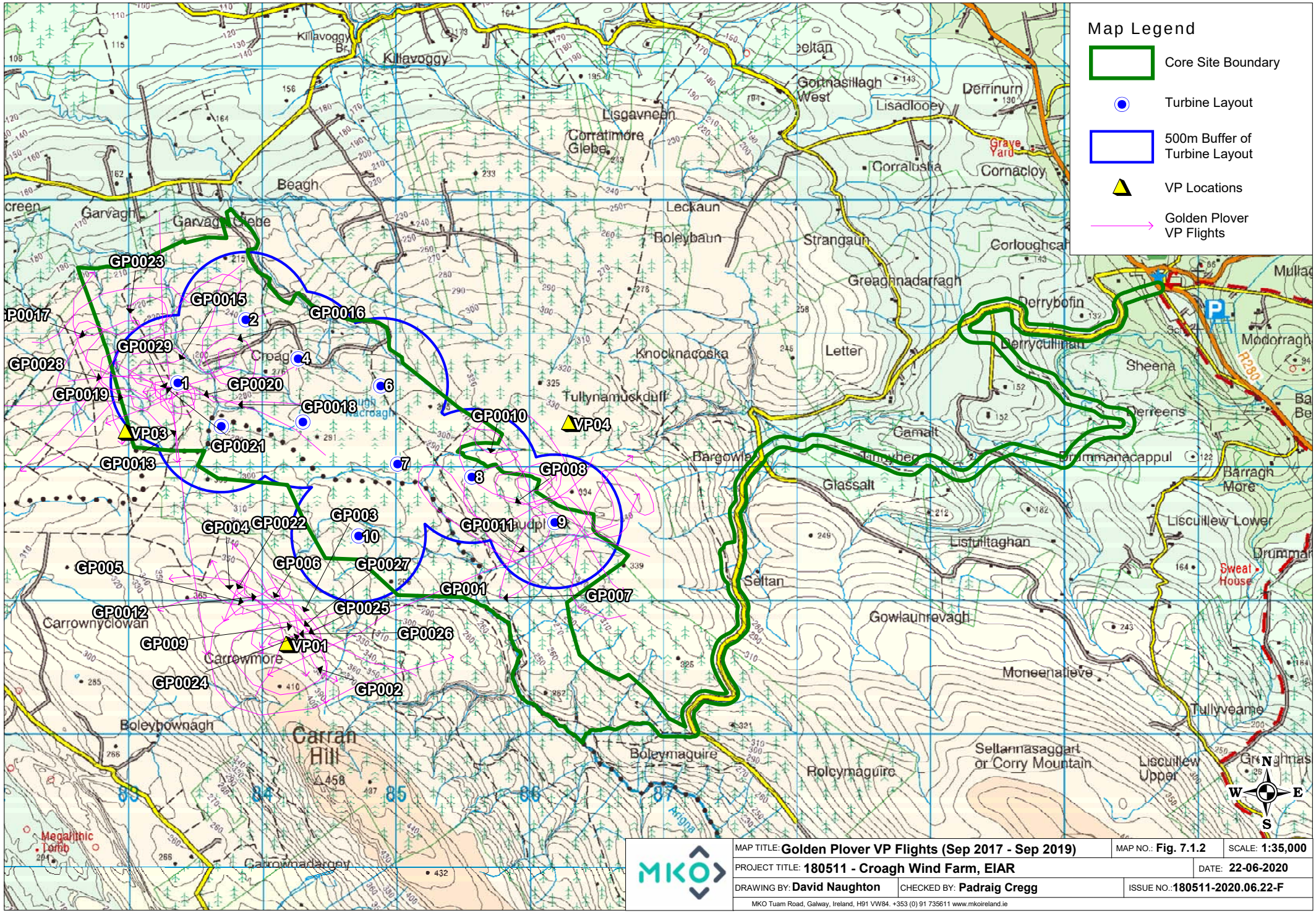
Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
GP001	10/11/2017	1	Golden Plover	1	12:26:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Golden Plover calling from the north west, 100-150m away. Approximate Grid Ref: G 8405 2175	LD
GP002	10/11/2017	1	Golden Plover	1	12:34:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Golden Plover calling on and off again from the same location above. A little longer this time 10-12 seconds.	LD
GP003	10/11/2017	1	Golden Plover	1	15:12:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Golden Plover heard calling from the W/NW around 150=200m from the VP, in the same vicinity as the birds flushed yesterday (see Incidental Notes for Grid Reference).	LD
GP004	10/11/2017	1	Golden Plover	1	15:16:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Two Golden Plover heard calling from the same area above, for around 16 seconds.	LD

Table 1-5 Golden Plover Winter Transect Survey Observations

Ref No.	Date	Transect/ Quadrat/ Point No.	Species	No. of Birds	Time of observation	Habitat	Notes (Comment on behaviour and activity)	Surveyor
GP001	16/10/2018		Golden Plover	40	14:34:00	GS4, (Wet grassland) PB2, (Upland blanket bog)	Flying flock	AOD
GP002	08/01/2019		Golden Plover	30	12:12:00	WD4, (Conifer plantation)	Travelling in echelon	JK

Table 1-6 Golden Plover Incidental Observations

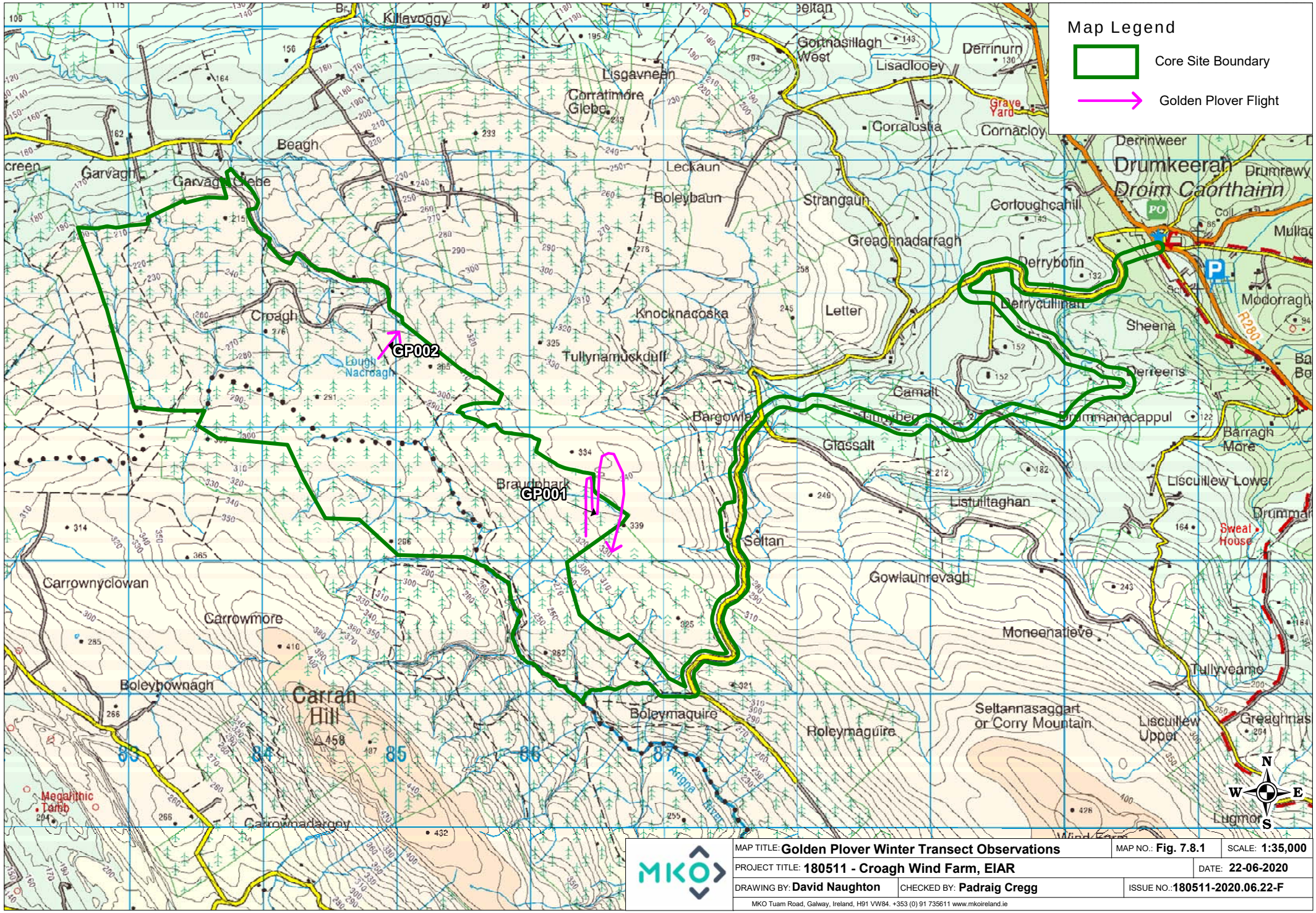
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
GP003	17/05/2018	Breeding Raptor Survey	Carran Hill VP- A	Golden Plover	1	Possible breeding Golden Plover heard calling in dense heather and moorland grass. Approx. Grid Ref: G 8285 2205.	LD
GP004	13/03/2019	Red Grouse Survey		Golden Plover	26	flushed. 586652.863324922, 822681.874708627	JC
GP001	10/11/2017	Vantage Point Survey	VP1	Golden Plover	6	Golden Plover heard calling from the VP, but another six were flushed whilst walking out. Grid Ref: 8390 2175.	LD
GP002	25/01/2018	Vantage Point Survey	VP1	Golden Plover	50-60	Flushed a large flock of Golden Plover from the heather shortly after seeing the Snipe. Around 50-60 birds flew up, circled overhead before flying away. Grid Ref: 8382 2192	LD



MAP TITLE: **Golden Plover VP Flights (Sep 2017 - Sep 2019)**	MAP NO.: **Fig. 7.1.2**	SCALE: **1:35,000**	
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**		DATE: **22-06-2020**	
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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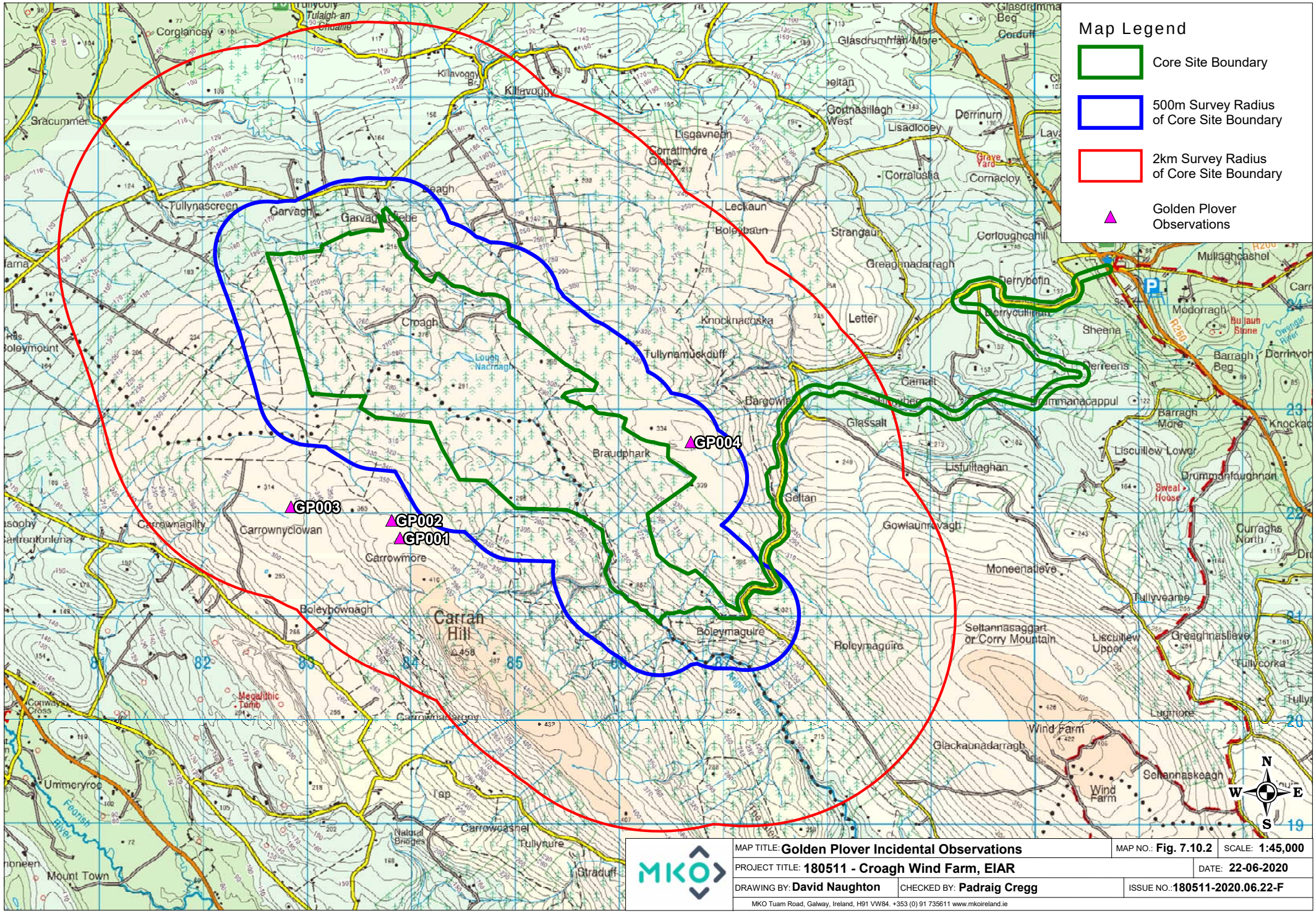
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MAP TITLE: **Golden Plover Winter Transect Observations**		MAP NO.: **Fig. 7.8.1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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MAP TITLE: **Golden Plover Incidental Observations**		MAP NO.: **Fig. 7.10.2**	SCALE: **1:45,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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Table 1-7 Hen Harrier Vantage Point Survey Observations

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
HH002	29/04/2018	4	Hen Harrier	1	10:11:00	15	15		10	5			WD4, (Conifer plantation) Male HH flies at buzzard. buzzard soars up	Buzzard soars south to north direction	SF
HH004	21/06/2018	3	Hen Harrier	1	12:39:00	10			10				PB2, (Upland blanket bog) PB4, (Cutover bog) Hunting over bog	Seen briefly hunting low over edge of secondary rotation	RW
HH008	27/08/2018	3	Hen Harrier	1	12:45:00	75	75			50	25		PB2, (Upland blanket bog) WD4, (Conifer plantation) hunting female/juv		DM
HH005	28/08/2018	1	Hen Harrier	1	10:30:00	55		55		55			PB2, (Upland blanket bog) hunting female		DM
HH006	28/08/2018	1	Hen Harrier	1	12:10:00	60	60			20	40		PB2, (Upland blanket bog) WD4, (Conifer plantation) hunting male		DM
HH007	28/08/2018	1	Hen Harrier	1	13:45:00	90		90		90			PB2, (Upland blanket bog) hunting female		DM
HH0010	05/12/2018	3	Hen Harrier	1	10:26:00	25	7	18	25				PB4, (Cutover bog) hunting over bog	Male	JK
HH0011	07/08/2019	1	Hen Harrier	1	19:30:00	25	25		5	20			PB4, (Cutover bog) Travelling; circling low, possibly to roost	Male	JK

Table 1-8 Hen Harrier Breeding Bird Survey Observation

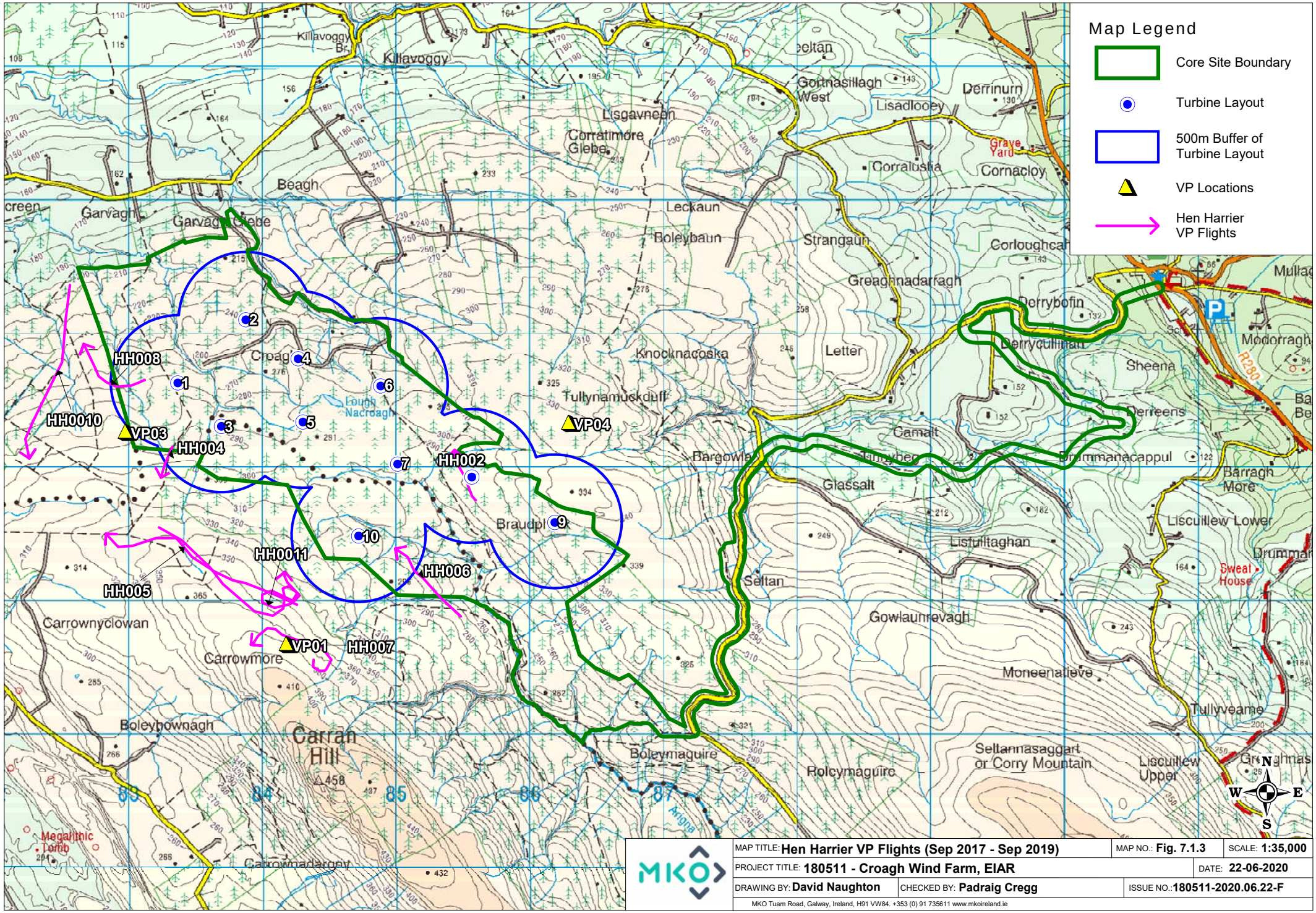
Map Ref. No.	Date	Transect/Area	Species Name	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
HH001	25/06/2019		Hen Harrier	1				Adult male foraging. band2 100s west to east	AOD

Table 1-9 Hen Harrier Breeding Raptor Survey Observations

Map Reference No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
HH001	07/05/2018	VP-A	Hen Harrier	1	12:20:00	2	HH1, (Dry siliceous heath) GS4, (Wet grassland) Flying into dense grass and heather.	Very brief view of a possible male Hen Harrier from a transect walked at VP-A. Saw a light-coloured raptor size species 6-700m north-west of the track marked on the map, which landed in dense grass. Only saw it for a second or two with the naked eye, it looks like good foraging habitat, comprising a large area of open moorland, Molinia and heather.	LD
HH002	23/07/2019	7	Hen Harrier	1	11:35:00	240	GS2, (Dry meadows and grassy verges) Hunting	Male	JK

Table 1-10 Hen Harrier Roost Survey Observations

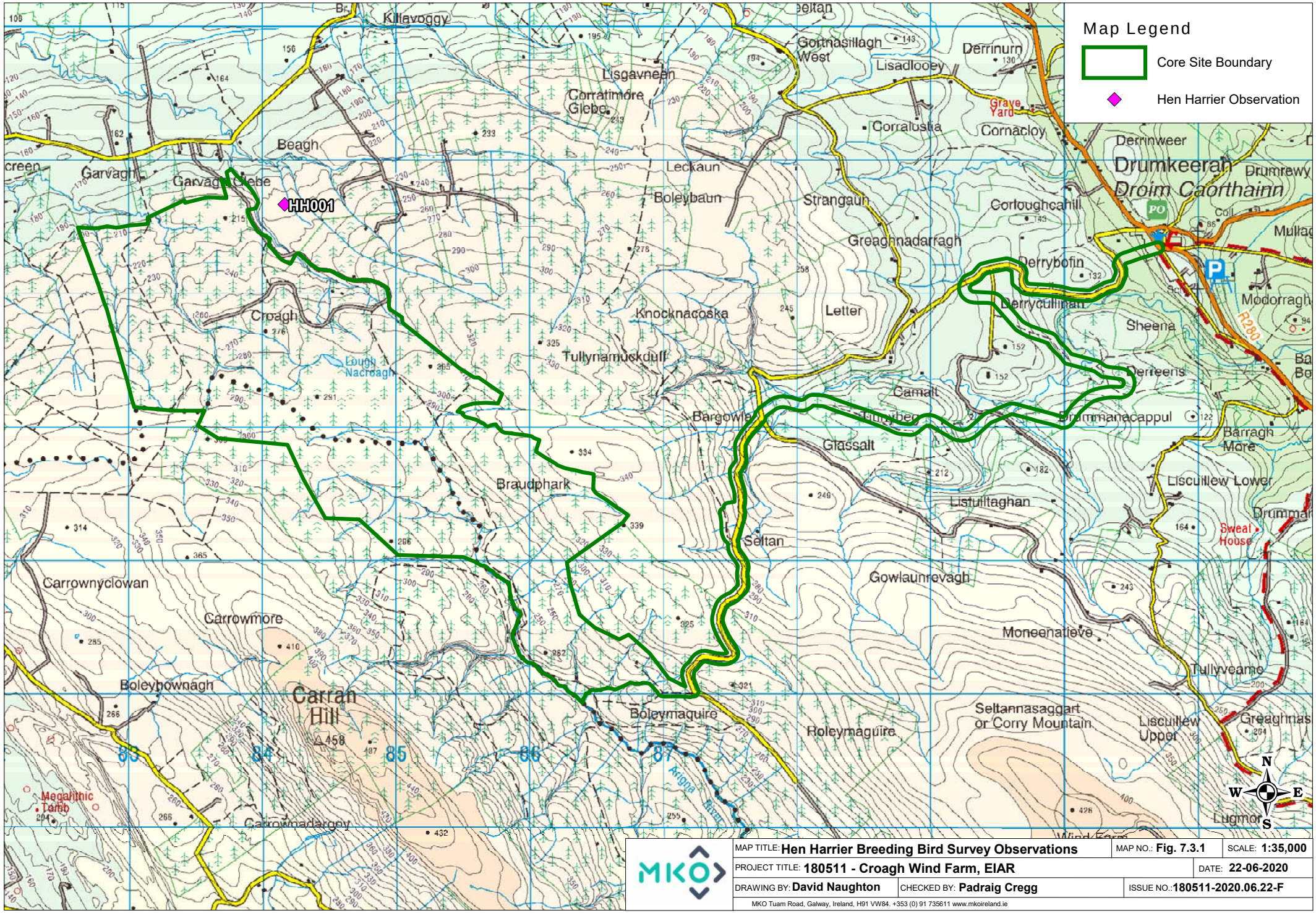
Map Ref. No.	Date	HHVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
HH001	25/03/2018	Site 1	Hen Harrier	1	18:23:00	8	HH1, (Dry siliceous heath) GS4, (Wet grassland) Male Hen Harrier flying low over heather moorland before landing to roost	Roost Identified	LD
HH002	26/10/2018	HHVP1	Hen Harrier	1	18:34:00	7	PB2, (Upland blanket bog) Adult male flying low band1		AOD



MAP TITLE: **Hen Harrier VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.3**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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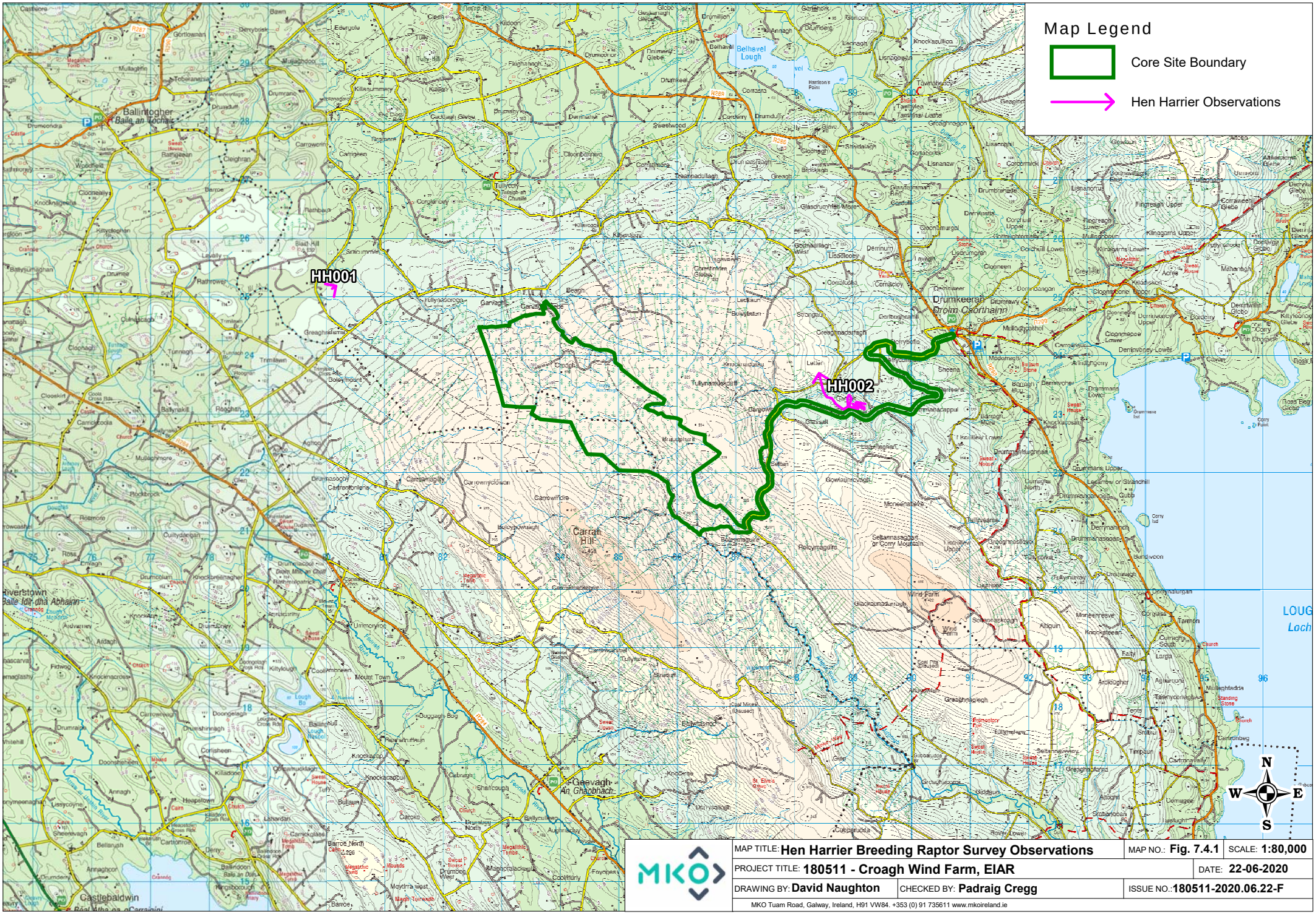
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MAP TITLE: **Hen Harrier Breeding Bird Survey Observations**		MAP NO.: **Fig. 7.3.1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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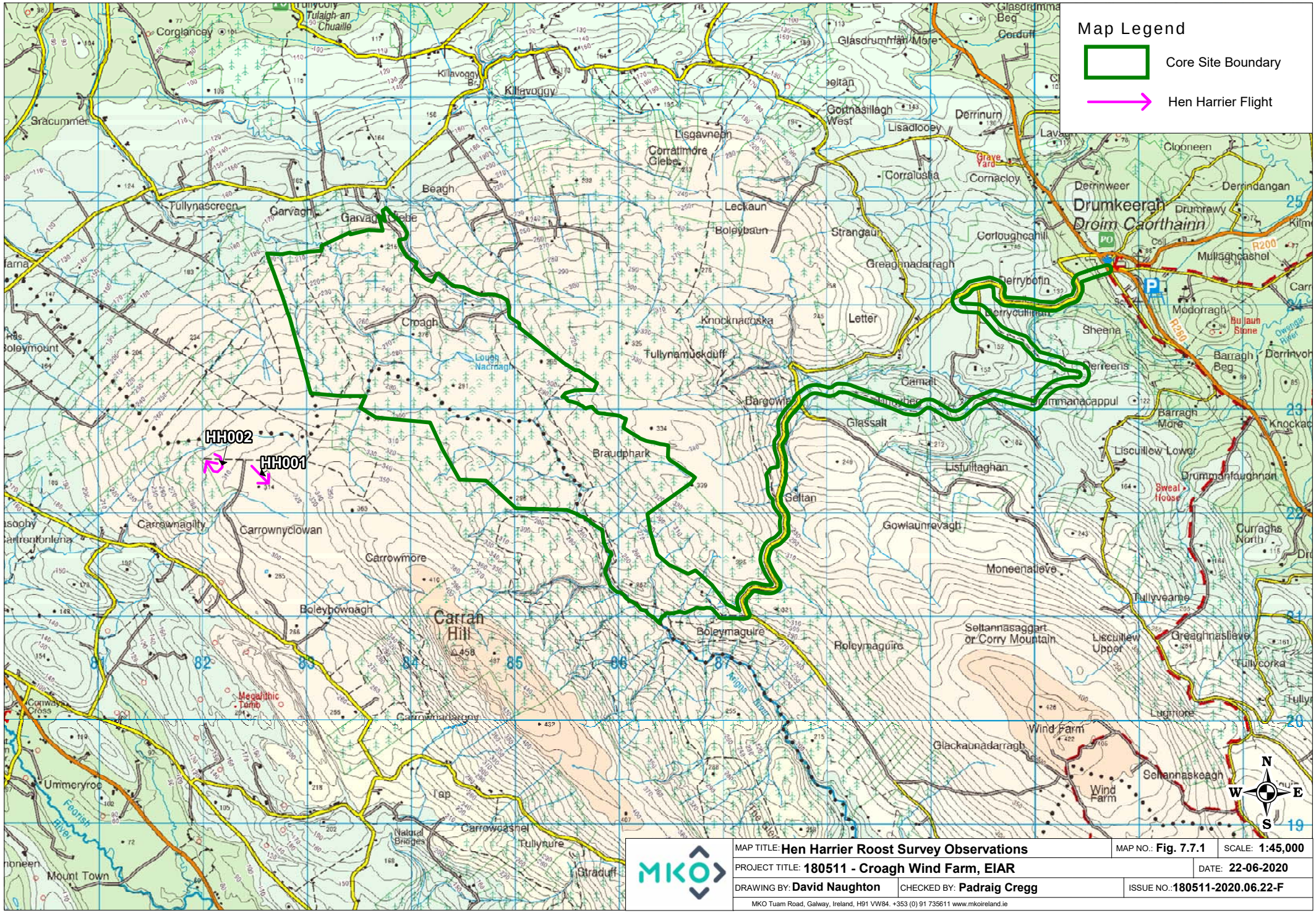
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MAP TITLE: **Hen Harrier Breeding Raptor Survey Observations**		MAP NO.: **Fig. 7.4.1**	SCALE: **1:80,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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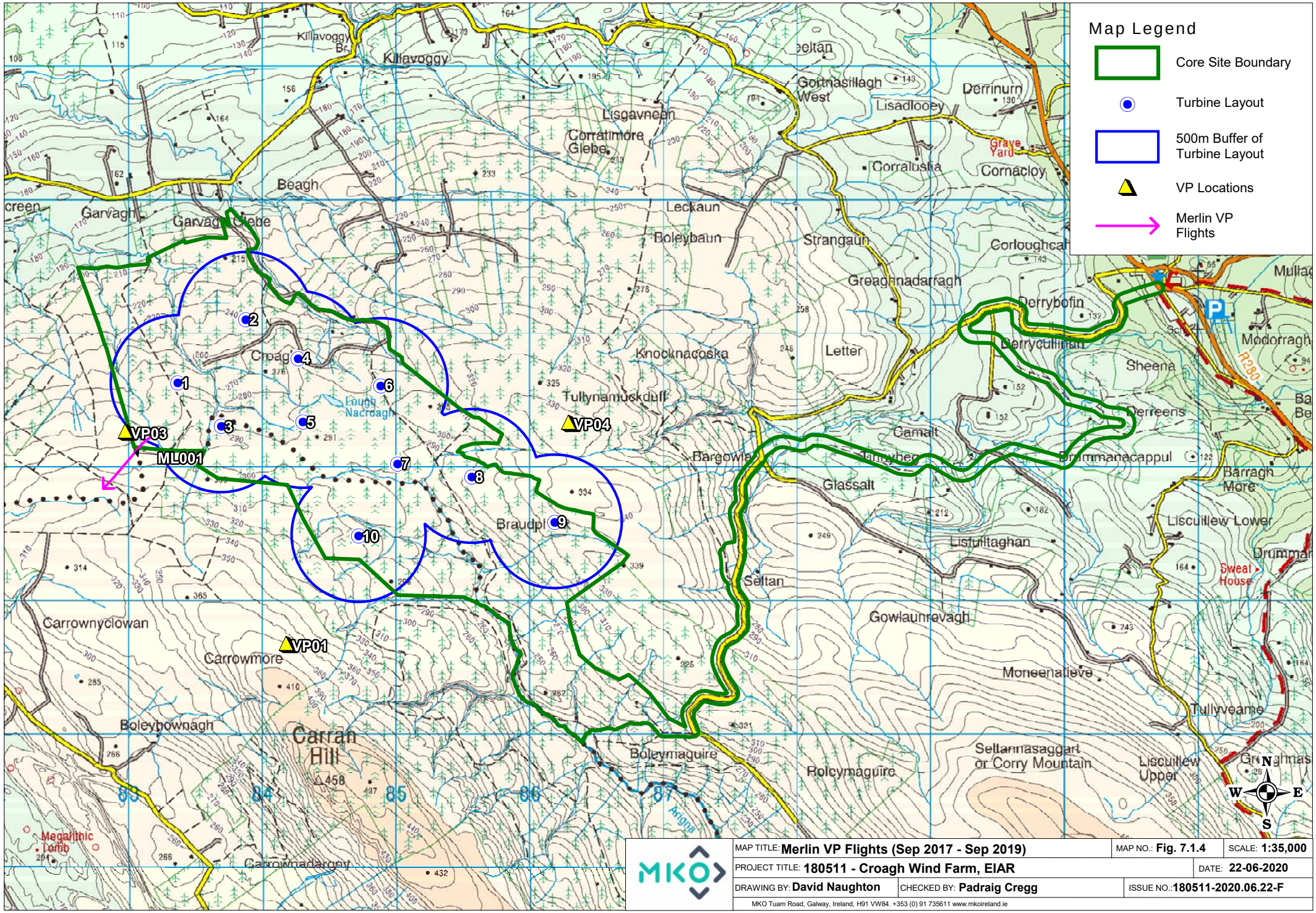
MAP TITLE: **Hen Harrier Roost Survey Observations**		MAP NO.: **Fig. 7.7.1**	SCALE: **1:45,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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Table 1-11 Merlin Vantage Point Survey Observations

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Surveyor
ML001	17/09/2018	3	Merlin	1	08:00:00	35	20	15		20	15		PB2, (Upland blanket bog) WD4, (Conifer plantation) hunting	DM



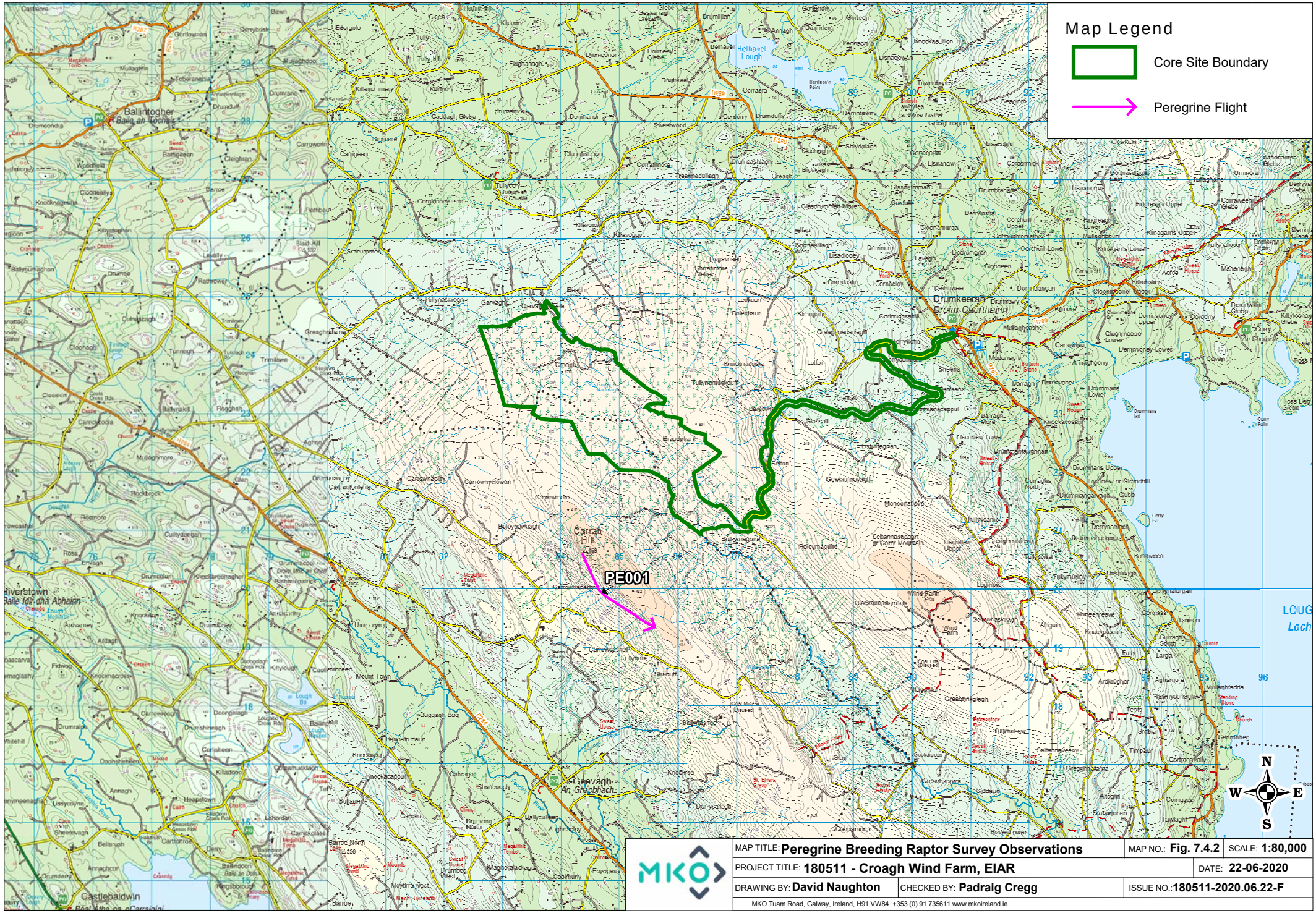
MAP TITLE: **Merlin VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.4**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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Table 1-12 Peregrine Breeding Raptor Survey Observation

Map Reference No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
PE001	17/07/2018		Peregrine	1	12:36:00	20	WD4, (Conifer plantation) Flying over	Adult Female	ED



MAP TITLE: **Peregrine Breeding Raptor Survey Observations** | MAP NO.: **Fig. 7.4.2** | SCALE: **1:80,000**

PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR** | DATE: **22-06-2020**

DRAWING BY: **David Naughton** | CHECKED BY: **Padraig Cregg** | ISSUE NO.: **180511-2020.06.22-F**

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Table 1-13 Red Grouse Vantage Point Survey Flights

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
RG001	20/12/2017	1	Red Grouse	3	09:25:00	20			20				PB2, (Upland blanket bog) flushed from heath		DM
RG002	02/05/2018	1	Red Grouse	1	06:15:00	15			15				PB2, (Upland blanket bog), WD4 (Conifer Plantation)		SF
RG003	15/01/2019	1	Red Grouse	1	11:02:00	6	6		6				PB4, (Cutover bog) Flushed from cutover		JK
RG004	05/09/2019	3	Red Grouse	2	06:10:00	5	2	3					HH4, (Montane Heath)	2 adults flew north low	AOD
RG005	05/09/2019	3	Red Grouse	2	06:36:00	3	3						HH4, (Montane Heath)	2 birds flew north towards site low	AOD

Table 1-14 Red Grouse Vantage Point Surveys Non-Visual Observations

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
RG001	20/03/2018	3	Red Grouse	1	19:17:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Red Grouse calling from the Calluna at dusk, around 100m north east of the VP.	LD
RG002	20/03/2018	3	Red Grouse	1	19:19:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	A separate Red Grouse started calling even closer, about 50-75m south of the VP.	LD
RG003	20/03/2018	3	Red Grouse	1	19:28:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) calling	A third bird then began calling, about 75-100m south-west of the Vantage Point. None of them seen.	LD
RG004	20/03/2018	3	Red Grouse	1	19:30:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) calling	Bird No. 2 started calling again.	LD
RG005	20/03/2018	3	Red Grouse	1	19:30:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) calling	Answered by the calling Red Grouse (Bird No. 3).	LD
RG006	29/04/2018	4	Red Grouse	1	06:19:00	WD4, (Conifer plantation) Calling	Not Seen	SF
RG007	02/05/2018	1	Red Grouse	1	07:11:00	PB4, WD4 Calling		SF
RG008	02/05/2018	1	Red Grouse	1	11:09:00	PB2, (Upland blanket bog) Calling		SF

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
RG009	02/05/2018	1	Red Grouse	1	07:20:00			SF
RG0010	17/09/2018	3	Red Grouse	1			heard calling	DM
RG0011	18/09/2018	1	Red Grouse	2			heard calling	DM
RG0012	30/04/2019	1	Red Grouse	2	21:30:00	HH4, (Montane heath) PB2, (Upland blanket bog) 2 RG calling	2 RG calling	AOD
RG0013	14/05/2019	3	Red Grouse	1	05:27:00	HH4, (Montane heath) Calling Male Not Seen		AOD
RG0014	15/05/2019	1	Red Grouse	1	05:05:00	HH4, (Montane heath) Calling Male Not Seen		AOD
RG0015	17/05/2019	2	Red Grouse	1	04:48:00	HH4, (Montane heath) Calling Male Not Seen		AOD
RG0016	18/06/2019	1	Red Grouse	1	12:48:00	HH1, (Dry siliceous heath) RG calling, heard a call like a mallard but more nasal and in single notes.	When listened to on Collins bird guide app the call was confirmed to be RG.	PW
RG0017	18/06/2019	1	Red Grouse	1	13:19:00	HH1, (Dry siliceous heath) RG calling		PW
RG0018	18/06/2019	1	Red Grouse	1	14:57:00	HH1, (Dry siliceous heath) RG called once		PW
RG0019	18/06/2019	1	Red Grouse	1	15:16:00	HH1, (Dry siliceous heath) RG called 5 times, heard only.		PW
RG0020	18/06/2019	1	Red Grouse	1	15:19:00	HH1, (Dry siliceous heath) RG called twice, heard only.		PW
RG0021	18/06/2019	1	Red Grouse	1	15:24:00	HH1, (Dry siliceous heath) RG called 4 times, heard only.		PW
	04/09/2019	1	Red Grouse	2			Calling until light	AOD
	05/09/2019	3	Red Grouse	3			Calling until light	AOD

Table 1-15 Red Grouse Breeding Walkover Survey Observations

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
RG001	10/07/2018		Red Grouse	1	12:58:00		PB2, (Upland blanket bog) Flushed from bog	Adult male	RW

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
RG002	25/06/2019		Red Grouse	1				Male flew SE 4s B1	AOD

Table 1-16 Red Grouse Tape Lure Survey Observations

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
RG001	24/03/2018	A	Red Grouse	1	15:42:00	12	HH3, (Wet heath) GS4, (Wet grassland) GS3, (Dry-humid acid grassland) Adult flew parallel to transect line calling in flight		CP
RG002	11/03/2019		Red Grouse	1	11:26:00		PB2, (Upland blanket bog) Calling	Adult male	JC

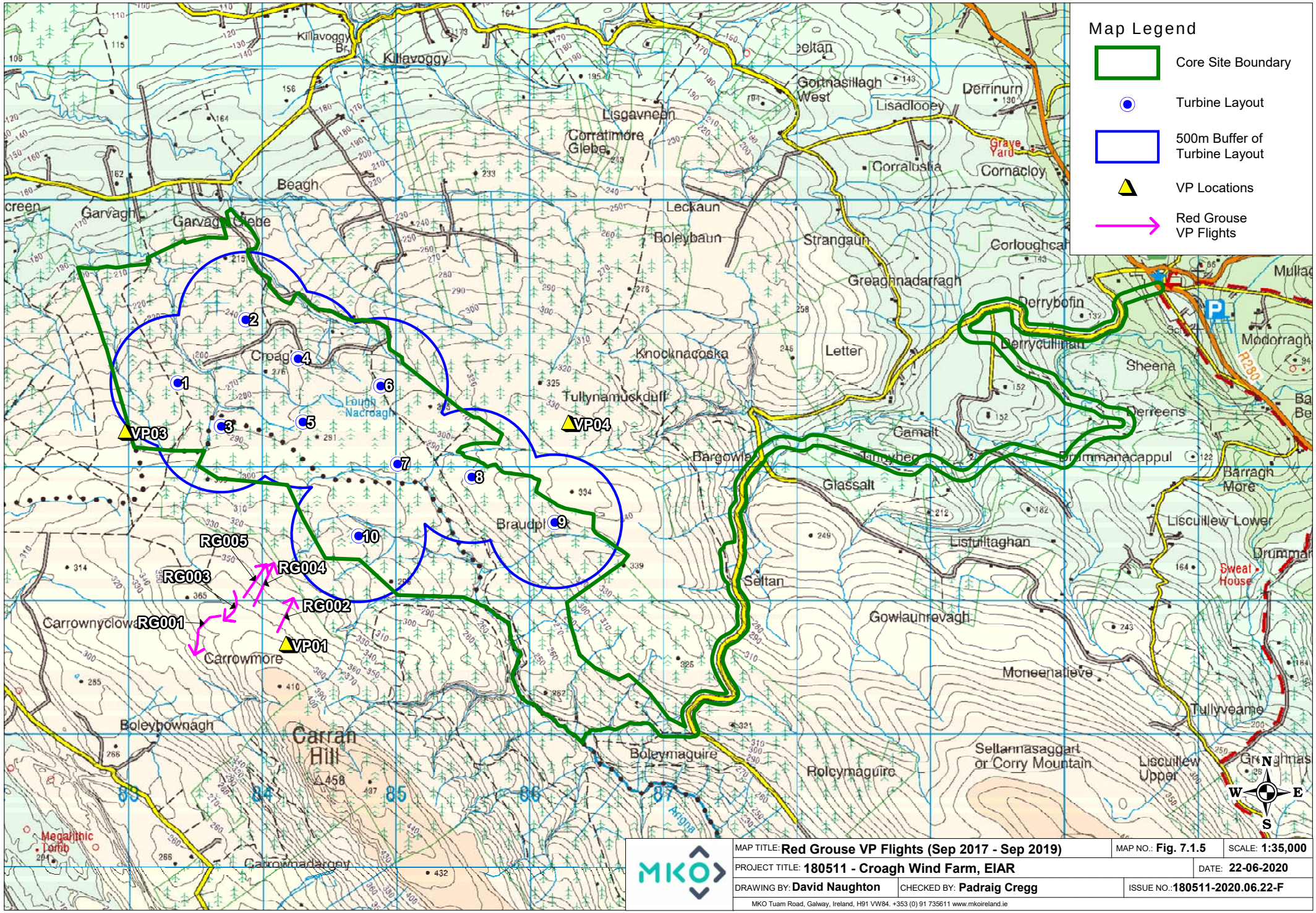
Table 1-17 Red Grouse Winter Transect Survey Observation

Ref No.	Date	Transect/ Quadrat/ Point No.	Species	No. of Birds	Time of observation	Habitat	Notes (Comment on behaviour and activity)	Surveyor
RG001	16/10/2018		Red Grouse	1	16:21:00	PB2, (Upland blanket bog)	Flushed bird	AOD

Table 1-18 Red Grouse Incidental Observations

Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
RG001	23/10/2017	Hen Harrier Roost Survey	Near HH01	Red Grouse	3	Flushed at about G/82415/21820, OOS.	CP
	26/10/2018	Hen Harrier Roost Survey	HHVP1	Red Grouse	1	Calling at HHVP1	AOD
RG002	20/11/2017	Vantage Point Survey	VP3	Red Grouse	2	Flushed a pair of Red Grouse walking in, around 150m west of the VP. Approximate Grid Ref: G 82850 23300. Both birds calling.	LD
	18/10/2018	Vantage Point Survey	VP4	Red Grouse	1	Calling at dusk near VP4	AOD
	23/10/2018	Vantage Point Survey	VP1	Red Grouse	1	Calling then flushed near VP	AOD
	01/11/2018	Vantage Point Survey	VP3	Red Grouse	3	At least 3 birds calling around VP after 17:30	AOD

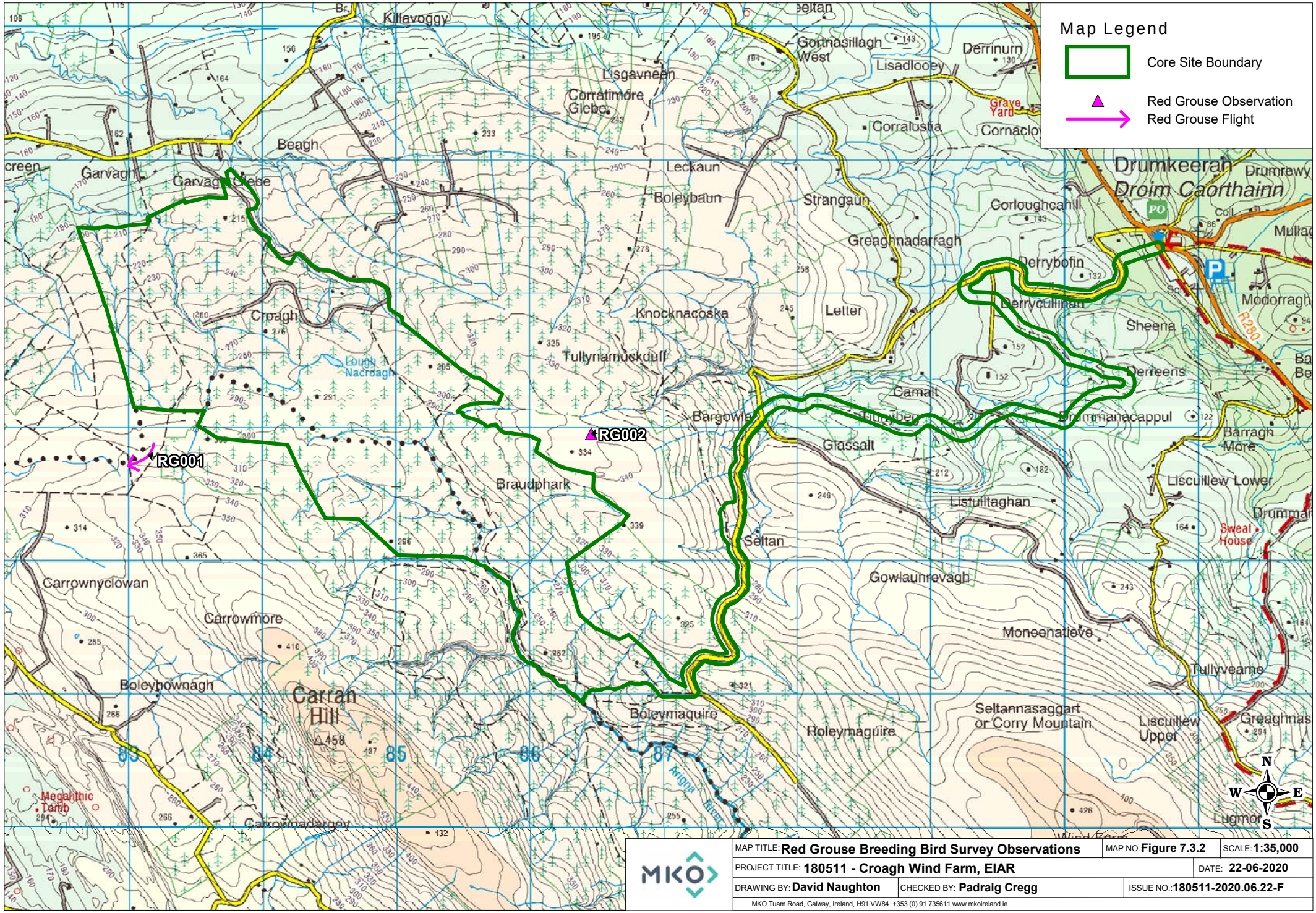
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
RG007	05/06/2019	Vantage Point Survey	Carran Hill IG 833 236	Red Grouse	1	Possible Red Grouse recorded on way in to VP3 flushed from grass trackway across heather moorland.	PW
RG001	07/05/2019	Breeding Raptor Survey	RVP10	Red Grouse	1	Red Grouse calling from the Calluna and area of grassland.	LD
RG002	09/05/2019	Breeding Raptor Survey	RVP3	Red Grouse	1	Red Grouse heard calling from the Calluna.	LD
RG003	09/05/2019	Breeding Raptor Survey	RVP3	Red Grouse	1	Red Grouse heard calling from the Calluna.	LD



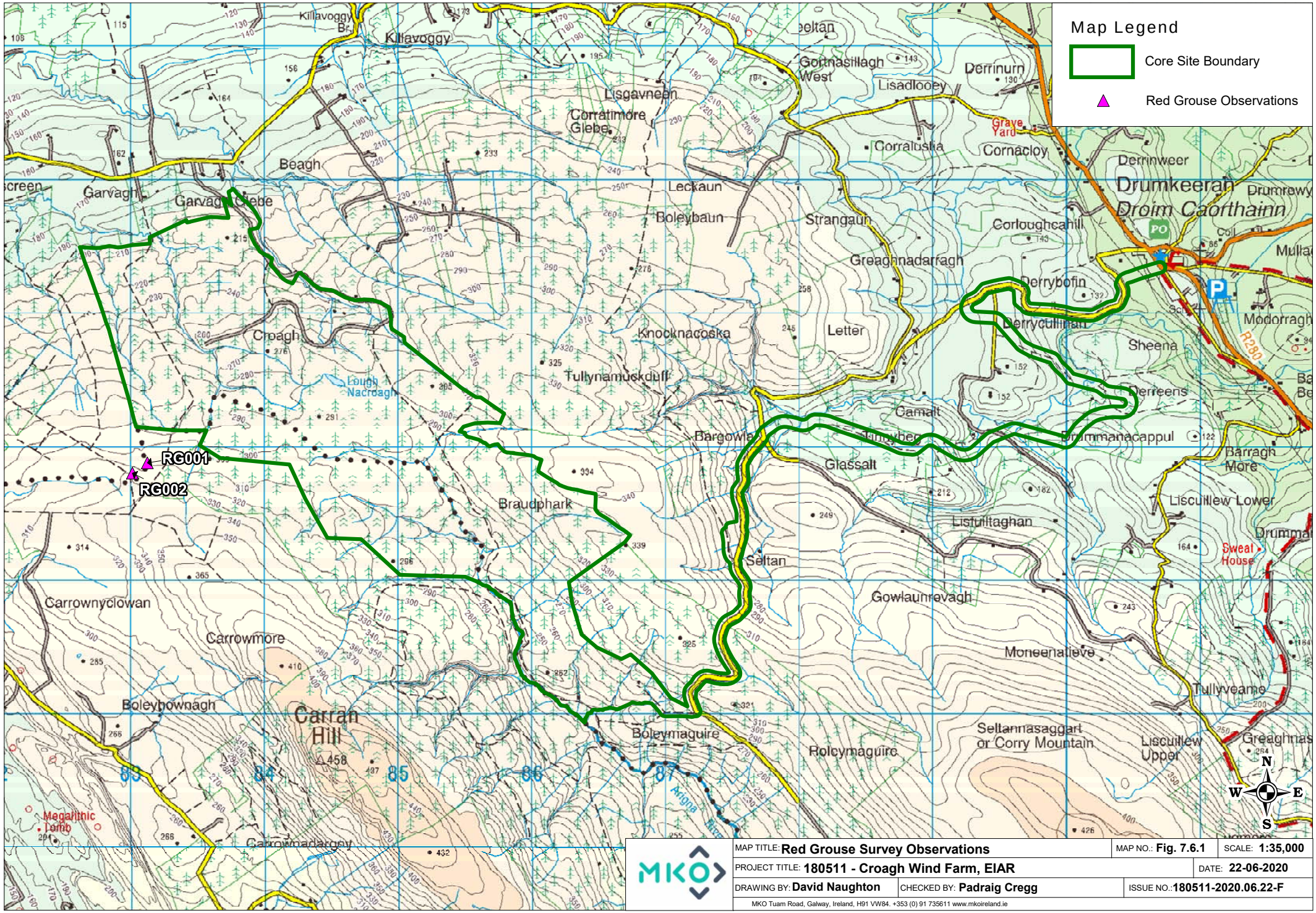
MAP TITLE: **Red Grouse VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.5**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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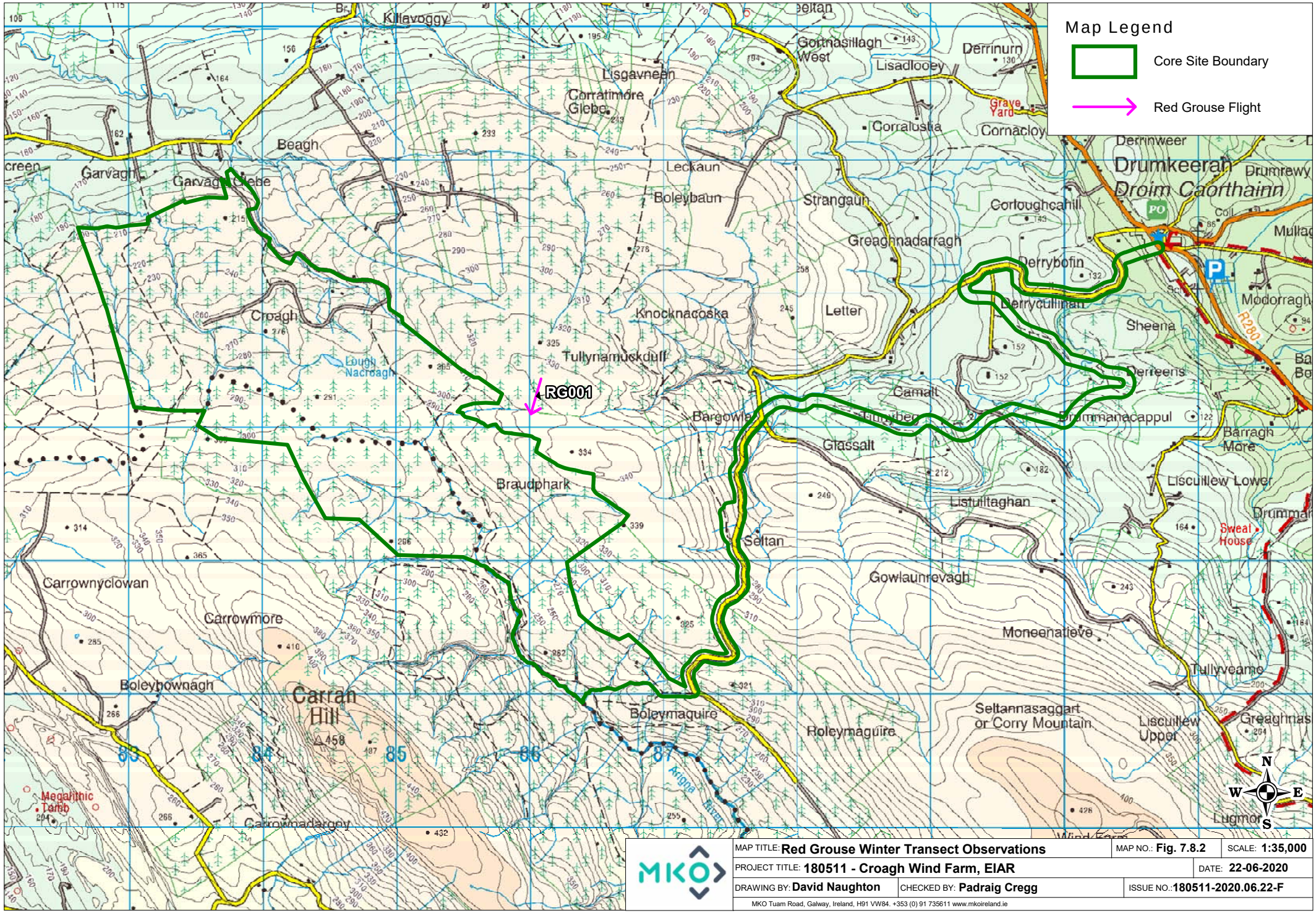
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MAP TITLE: **Red Grouse Survey Observations**		MAP NO.: **Fig. 7.6.1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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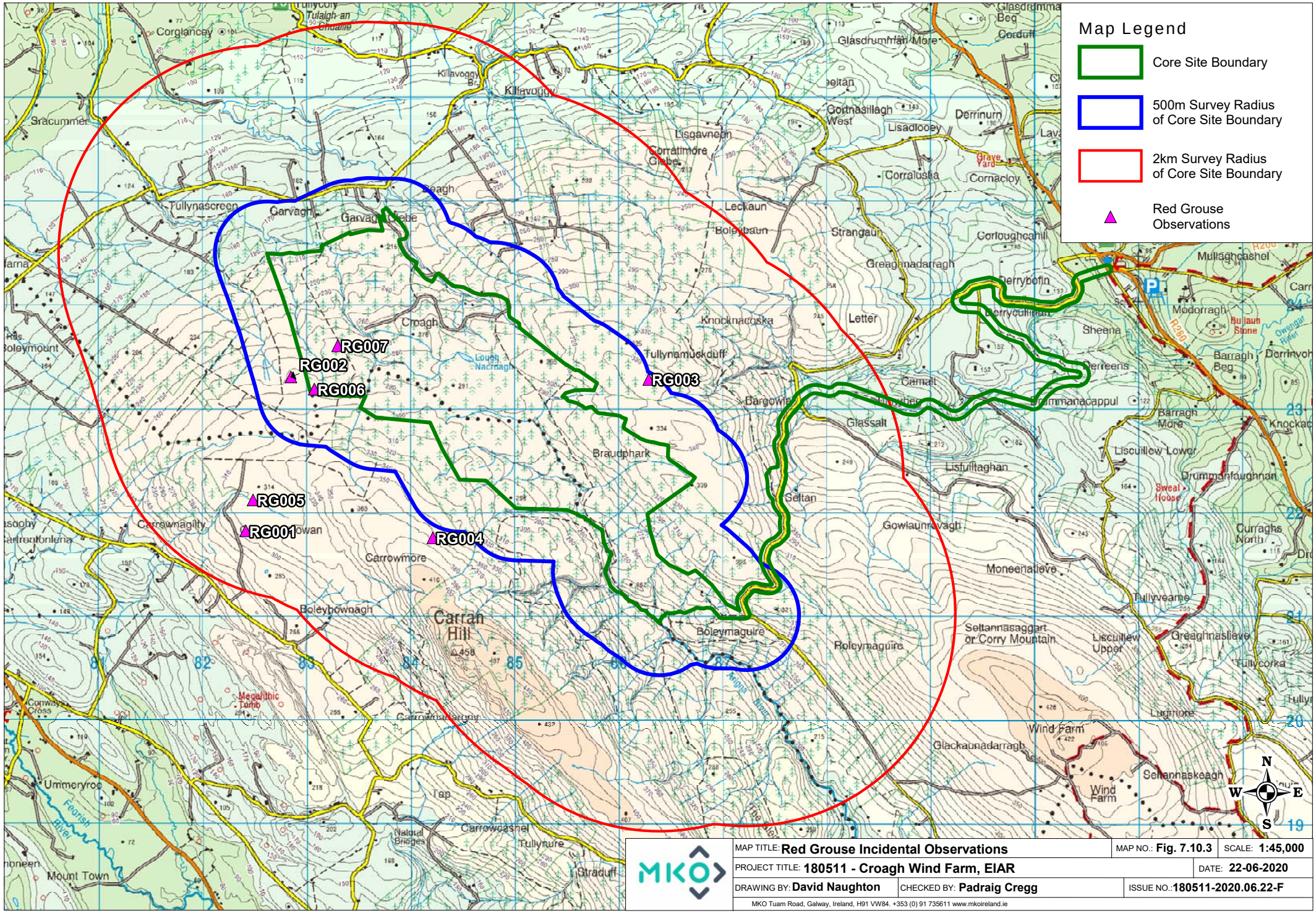
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MAP TITLE: **Red Grouse Winter Transect Observations**		MAP NO.: **Fig. 7.8.2**	SCALE: **1:35,000**
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MAP TITLE: **Red Grouse Incidental Observations**		MAP NO.: **Fig. 7.10.3**	SCALE: **1:45,000**
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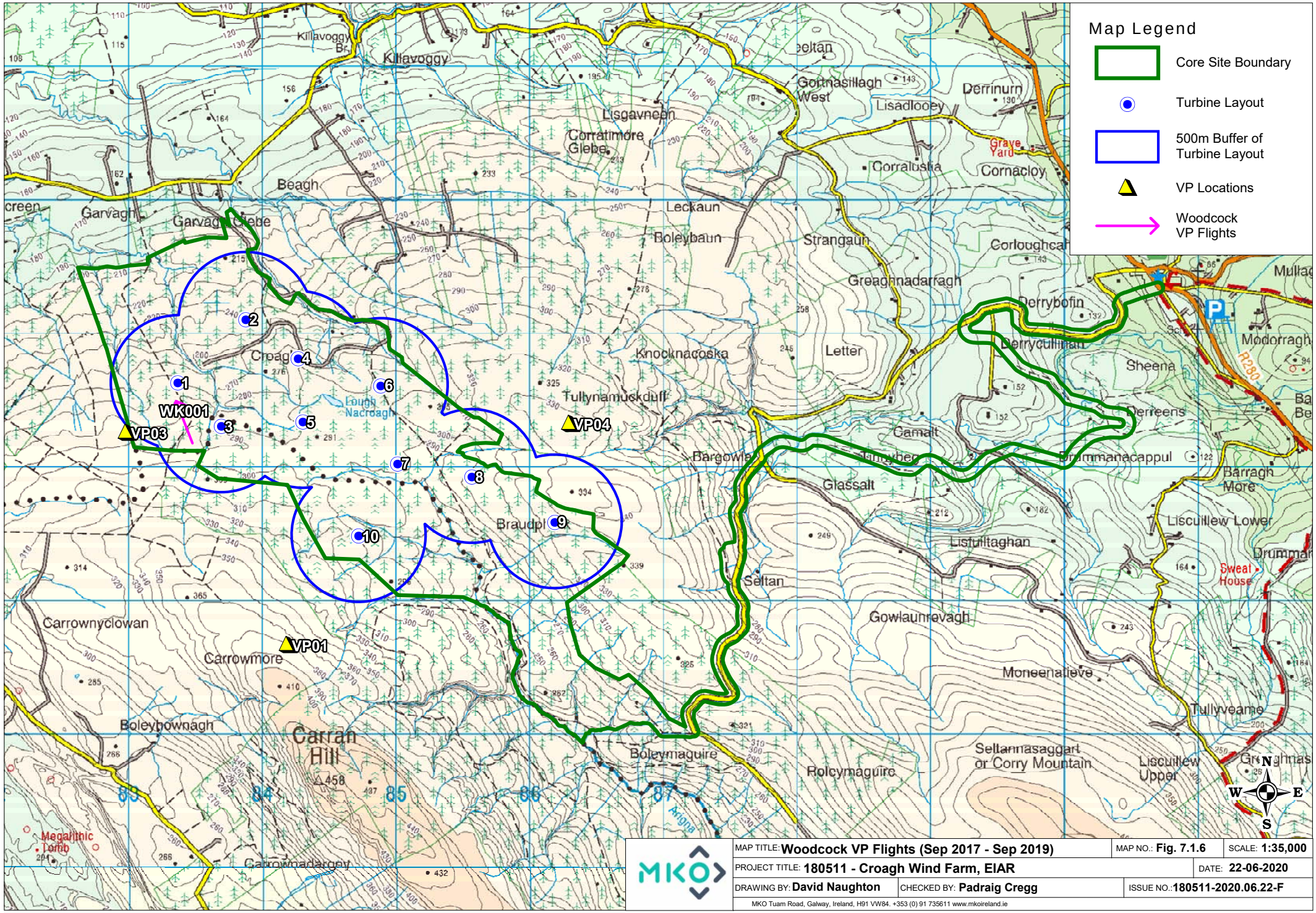
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Table 1-19 Woodcock Vantage Point Survey Observation

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
WK001	29/04/2019	3	Woodcock	1	21:18:00	8	8		8				WD4, (Conifer plantation) RODING MALE		AOD

Table 1-20 Breeding Woodcock Survey Observations

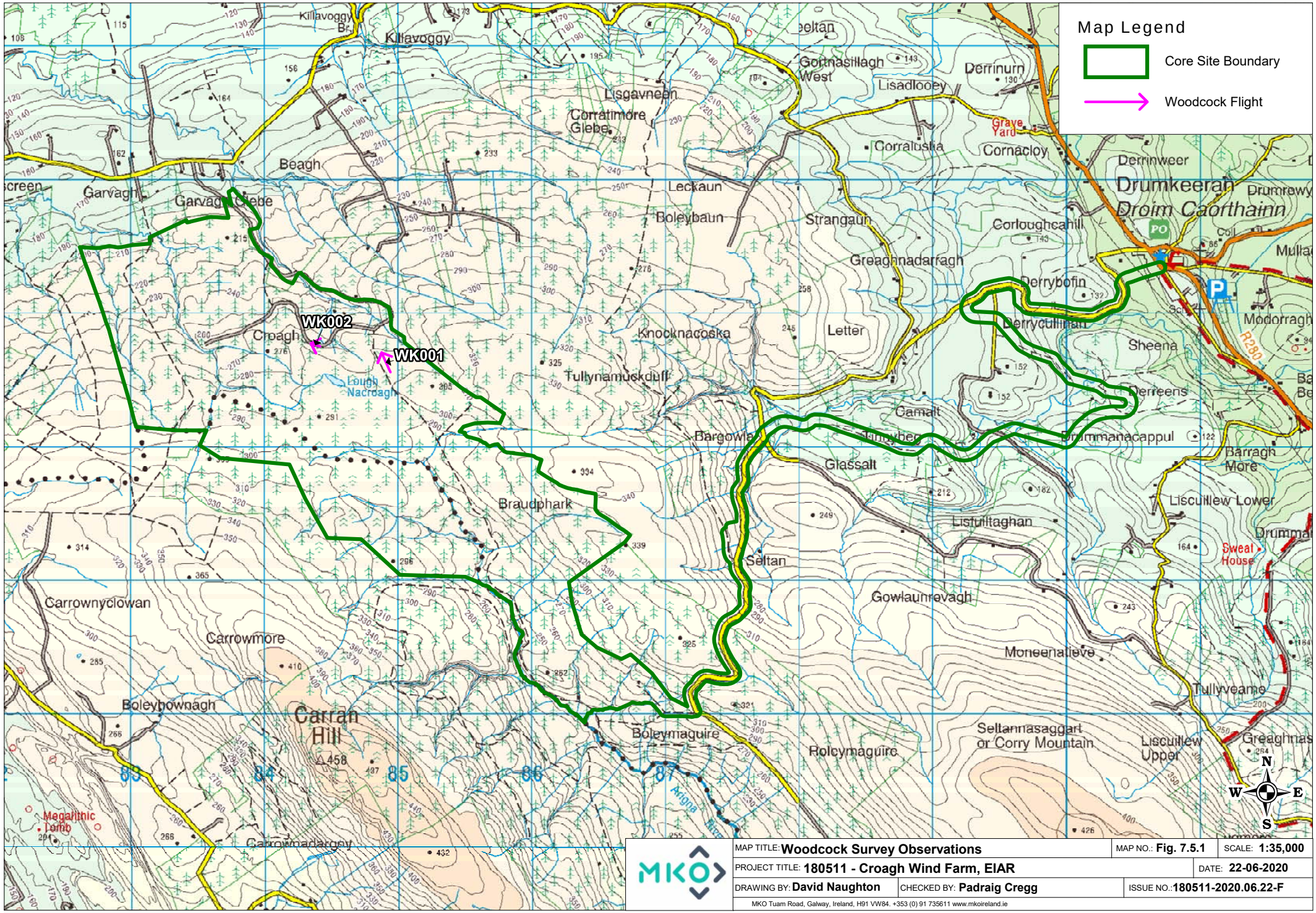
Map Ref. No.	Date	Transect/VP/Area	Species Name	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
WK001	04/06/2019	1	Woodcock	1	22:20:00	27	WD4, (Conifer plantation) Roding, flying and calling above and along forest road		PW
WK002	04/06/2019	1	Woodcock	1	22:30:00	10	WD4, (Conifer plantation) Roding, flying and calling		PW



MAP TITLE: **Woodcock VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.6**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**	

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MAP TITLE: **Woodcock Survey Observations**		MAP NO.: **Fig. 7.5.1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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Table 1-21 Curlew Vantage Point Survey Flight

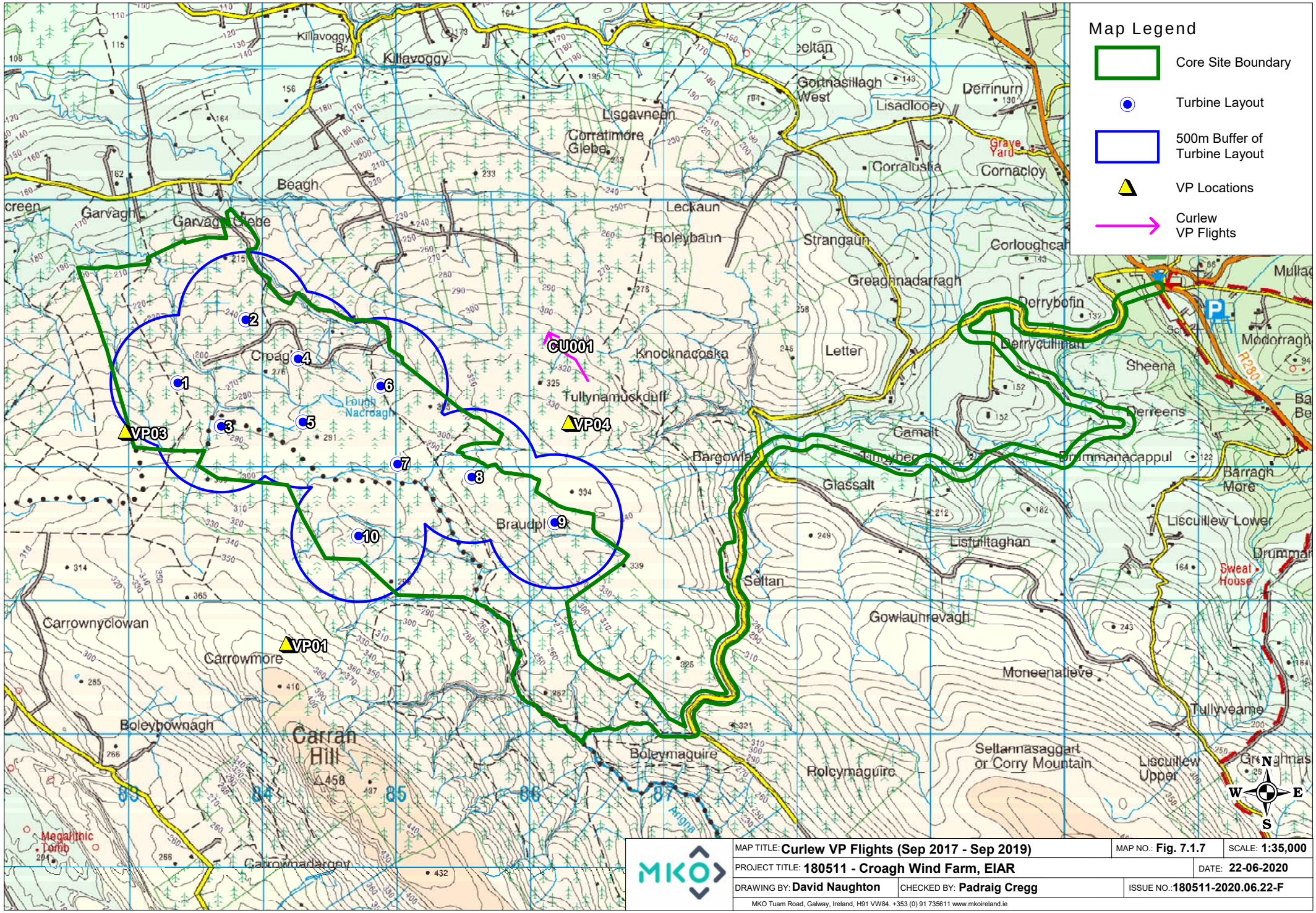
Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
CU001	29/04/2018	4	Curlew	1	09:45:00	10	0	10		10			flying over conifers		SF

Table 1-22 Curlew Vantage Point Survey Non-Visual Observations

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
CU002	29/04/2018	4	Curlew	1	05:28:00	Calling on site		SF
CU003	29/04/2018	4	Curlew	1	05:56:00	Calling off site		SF
CU004	29/04/2018	4	Curlew	1	06:45:00	on bog, on site		SF
CU005	29/04/2018	4	Curlew	2	07:18:00	on site calling		SF
CU006	29/04/2018	4	Curlew	1	07:53:00	calling		SF

Table 1-23 Curlew Incidental Observations

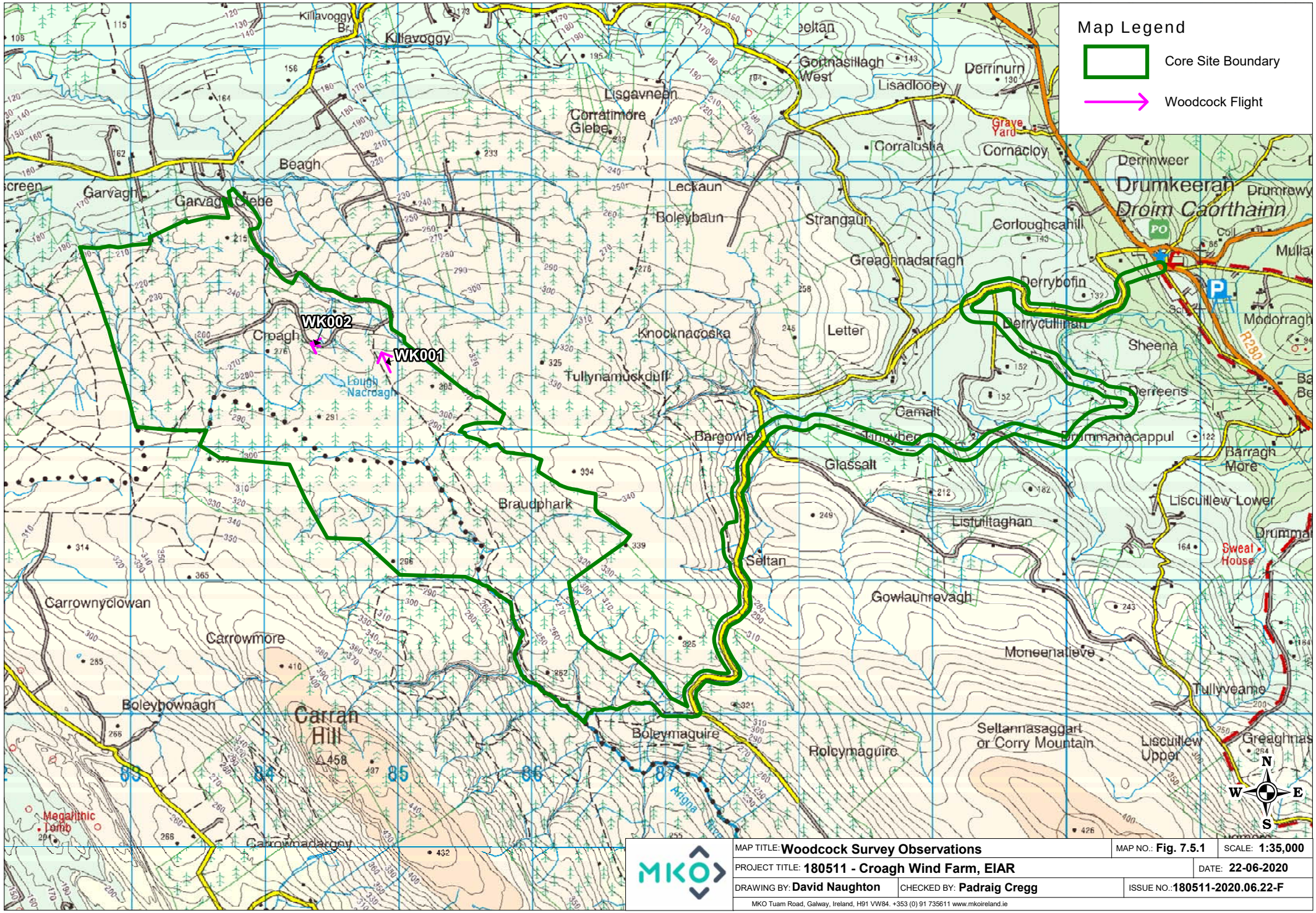
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
CU001	25/03/2018	Hen Harrier Roost Survey	Site 1	Curlew		Curlew heard bubbling/calling on and off for 28 seconds	LD
CU001	25/03/2018	Hen Harrier Roost Survey	Site 1	Curlew		Heard Calling again from the same location	LD



MAP TITLE: **Curlew VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.7**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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MAP TITLE: **Woodcock Survey Observations**		MAP NO.: **Fig. 7.5.1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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Table 1-24 Buzzard Vantage Point Survey Observations

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
BZ001	24/10/2017	3	Buzzard	1	13:35:00	47				20	27		Soaring, flap/glide, d/w, hunting.		CP
BZ002	24/02/2018	1	Buzzard	1	13:02:00	384				35	349		WD4, (Conifer plantation) PB2, (Upland blanket bog)	Meandered against wind flow, rising from 20-150m until lost from view	RW
BZ003	29/04/2018	4	Buzzard	1	10:00:00	30	30		30				WD4, (Conifer plantation) Flies onto ground and then up inot a tree perched approx 1.5km away		SF
BZ004	29/04/2018	4	Buzzard	1	10:18:00	420	420	20			400		WD4, (Conifer plantation) Buzzard soars on thermals		SF
BZ005	29/04/2018	4	Buzzard	1	10:59:00	20	20		20				WD4, (Conifer plantation) Buzzard flies below turbine prop at tree height <10m		SF
BZ006	01/11/2018	3	Buzzard	1	15:48:00	400	400	0			400		WD4, (Conifer plantation) PB2, (Upland blanket bog) Soaring		AOD
BZ007	14/03/2019	3	Buzzard	1	10:12:00	127			0	0	127		PB2, (Upland blanket bog) WD4, (Conifer plantation) Undulating flight in wind while heading N at 25-50m		RW
BZ008	26/03/2019	1	Buzzard	1	10:02:00	102			0	14	88	0	WD4, (Conifer plantation) PB2, (Upland blanket bog) Circled up to 60m over edge of forestry then moved S, passing over hill near VP at 15-20m	adult	RW

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
BZ009	05/06/2019	3	Buzzard	1	16:59:00	10		10		10			WD4, (Conifer plantation) HH1, (Dry siliceous heath) Flying		PW
BZ0011	18/06/2019	1	Buzzard	1	15:31:00	10		10			10		HH1, (Dry siliceous heath) BZ soaring over ridgeline in distance, disappearing behind the ridge.		PW

Table 1-25 Buzzard Breeding Walkover Survey Observation

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
BZ001	18/04/2019		Buzzard	1	11:44:00		Buzzard heard calling on and off for around a minute and a half behind a tall stand of conifers but did not see the bird.	Adult male	LD
BZ002	25/06/2019		Buzzard	1			Adult soaring band2 30s	Male flew SE 4S B1	AOD

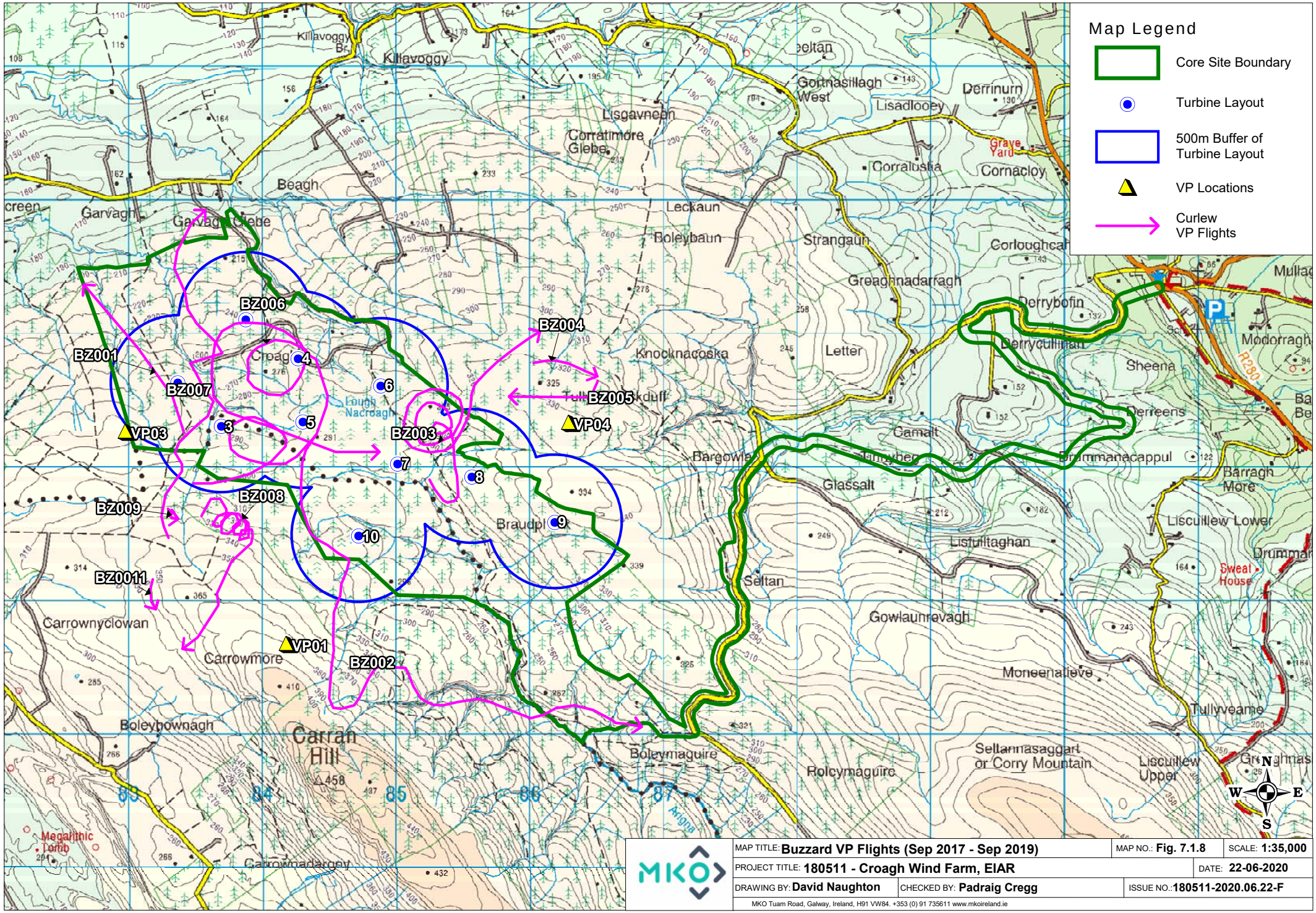
Table 1-26 Buzzard Breeding Raptor Observations

Map Ref. No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
BZ001	14/04/2018	VP_B	Buzzard	1	10:23:00		WD4, (Conifer plantation) GS4, (Wet grassland) Calling	Buzzard heard calling a few times behind the tall conifers in the distance, about 1km east of the VP-B.	LD
BZ002	06/05/2018	VP-B	Buzzard	1	13:36:00		WD4, (Conifer plantation) Calling	Buzzard heard calling again a couple of times, from the same area s the last survey at VP-B behind the tall conifers, but not seen. Approx. Grid Ref: G 9040 2735.	LD
BZ003	12/05/2018	VP-C	Buzzard	1	08:31:00	21	GS4, (Wet grassland) HH1, (Dry siliceous heath) WD4, (Conifer plantation) Soaring	Buzzard flying north-east over moorland, over a hill and out of view.	LD
BZ004	12/05/2018	VP-C	Buzzard	1	08:32:00	14	GS4, (Wet grassland) HH1, (Dry siliceous heath) WD4, (Conifer plantation) Soaring	Shortly followed by another Buzzard heading in the same direction. Presumably a pair.	LD

Map Ref. No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
LD101	25/04/2019	VP1	Buzzard	2	10:22:00	81	HH1, (Dry siliceous heath) WD4, (Conifer plantation) GS4, (Wet grassland) Travelling	Saw a pair of Buzzard's travelling in flight. The birds were flying south-west over moorland, before dropping low over conifers. See map for location.	LD
BZ006	02/05/2019	6	Buzzard	2	10:38:00	16	GS4, (Wet grassland) WD4, (Conifer plantation) Soaring, then travelling	Saw a pair of Buzzard's soaring initially, then travelling in flight around 0.5km north-west of VP6.	LD
BZ007	22/05/2019	1	Buzzard	1	10:17:00	909	WD4, (Conifer plantation) GS4, (Wet grassland) HH1, (Dry siliceous heath) Travelling, then landing.	Buzzard seen in flight travelling over moorland. It landed in trees for around 15 minutes, before flying off again.	LD
BZ008	22/05/2019	1	Buzzard	1	10:32:00	26	WD4, (Conifer plantation) GS4, (Wet grassland) HH1, (Dry siliceous heath) Travelling.	Second Buzzard seen flying from east to west, in the direction of the first bird seen above.	LD
LD102	02/06/2019	2	Buzzard	1	08:06:00	7	GS4, (Wet grassland) WD4, (Conifer plantation) Travelling	Buzzard seen briefly in flight before losing it behind trees. It was travelling north-east towards an area where a pair has been seen from VP1.	LD

Table 1-27 Buzzard Incidental Observation

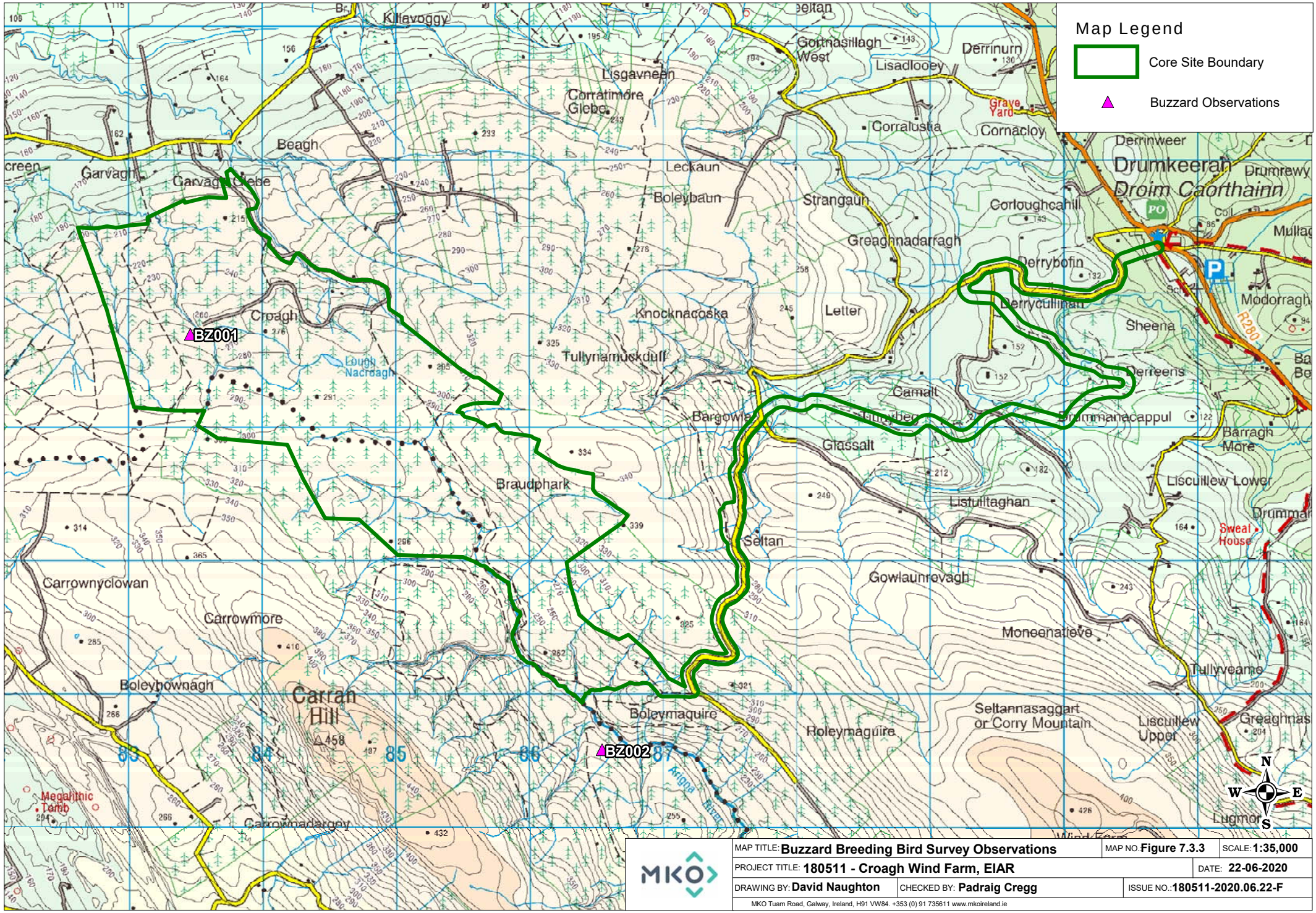
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	09/05/2019	Breeding Raptor	Close to VP 3 and 5	Buzzard	1	Probable Buzzard seen in flight travelling over moorland when heading off site. I was driving at the time, so cannot confirm this.	LD



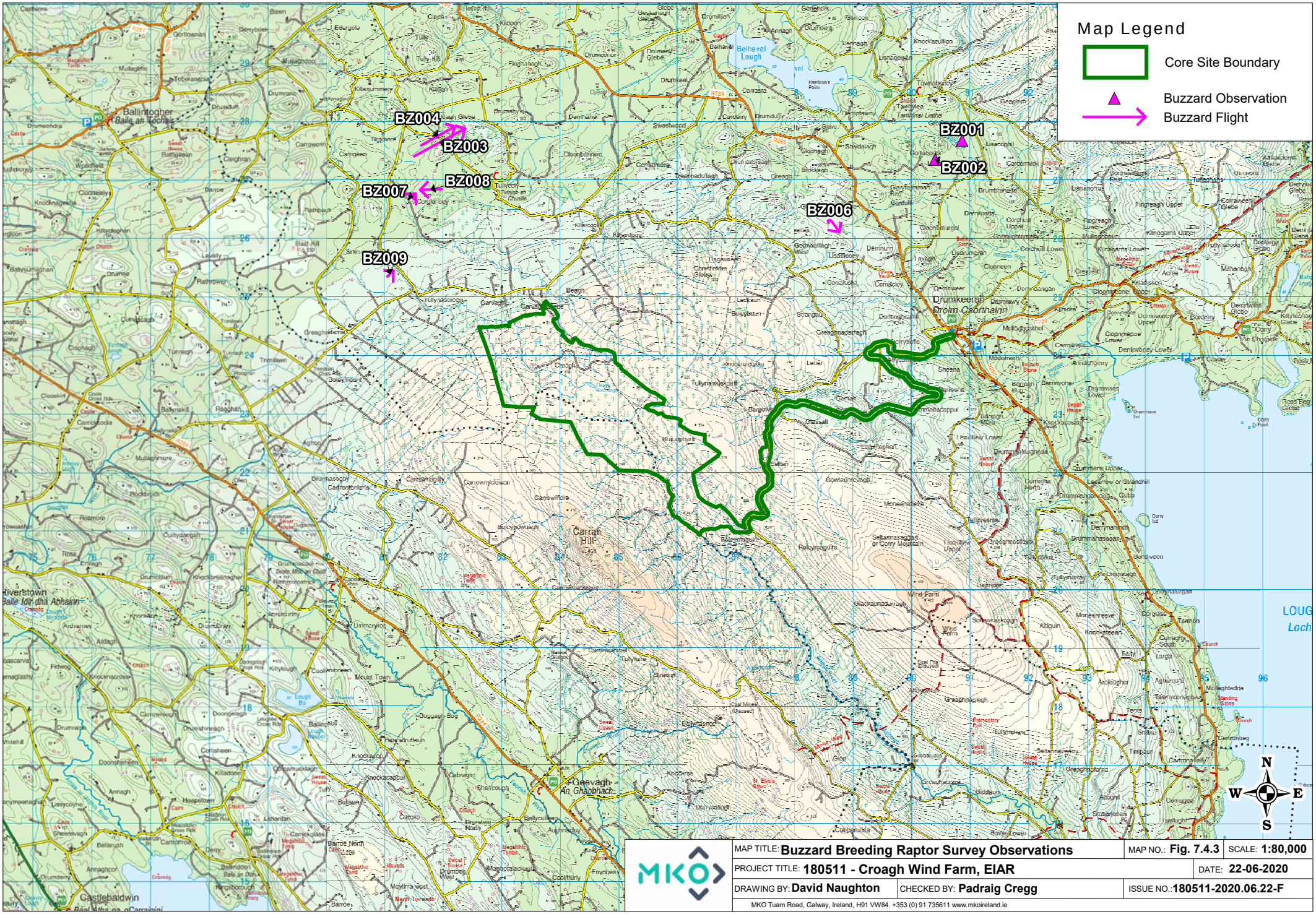
MAP TITLE: **Buzzard VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.8**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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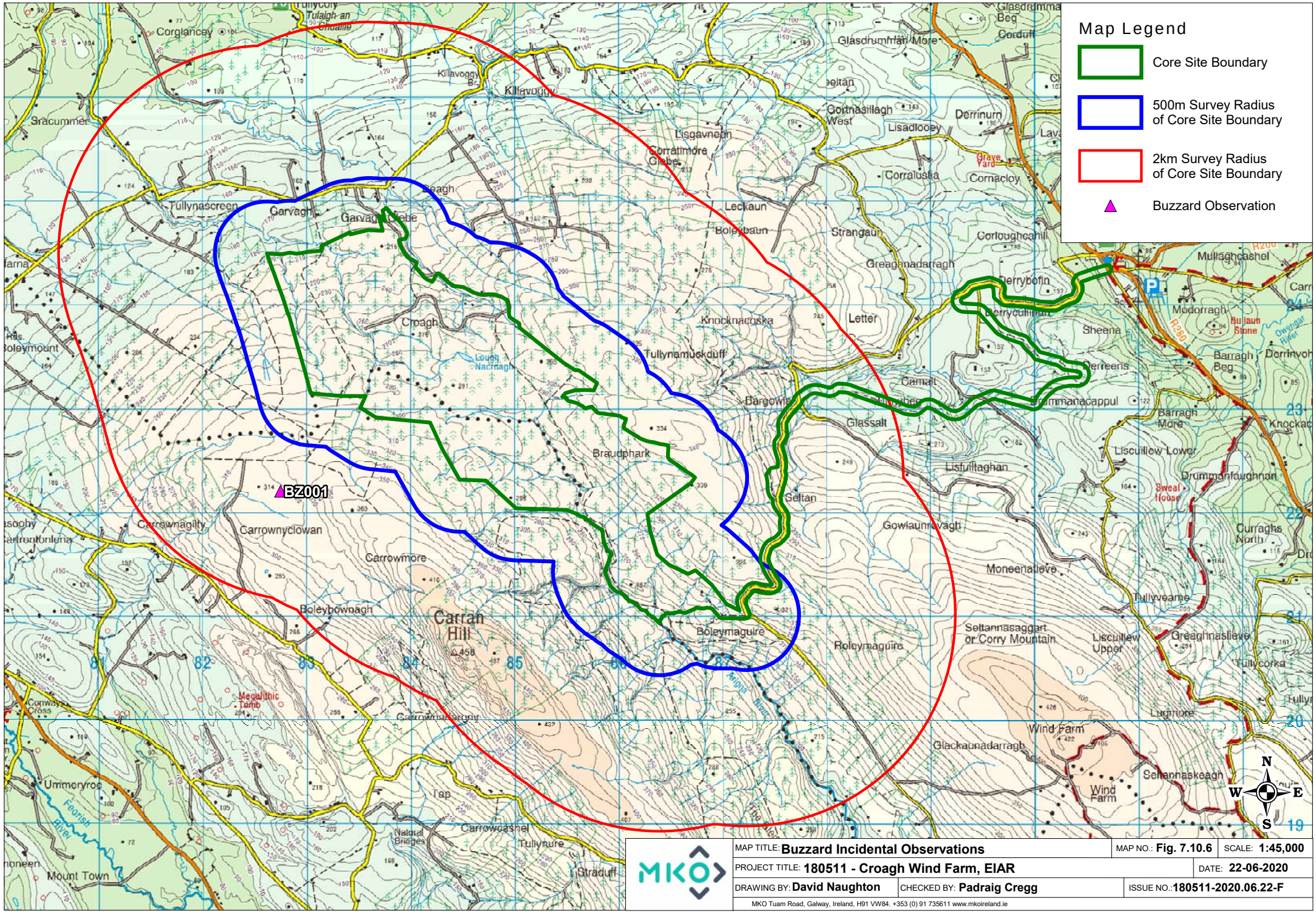
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MAP TITLE: **Buzzard Breeding Raptor Survey Observations**		MAP NO.: **Fig. 7.4.3**	SCALE: **1:80,000**
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MAP TITLE: **Buzzard Incidental Observations**		MAP NO.: **Fig. 7.10.6**	SCALE: **1:45,000**
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Table 1-28 Sparrowhawk Vantage Point Survey Data

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
SH001	13/08/2018	4	Sparrowhawk	1	16:10:00	10		10		10			WD4, (Conifer plantation) hunting in conifers		DM
SH002	23/10/2018	1	Sparrowhawk	1	15:30:00	40		40	40				WD4, (Conifer plantation) GS4, (Wet grassland) Hunting perched	Female adult	AOD
SH004	13/06/2019	4	Sparrowhawk	1	14:01"08	118	118				110	8	WD4, (Conifer plantation) Soaring before disappearing from view after rising above PCH.		PW

Table 1-29 Sparrowhawk Breeding Walkover Survey Data

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
SH001	18/04/2019	South-West	Sparrowhawk	1	12:41:00		Scrub Flushed, then flying	Flushed a Sparrowhawk from an area of scrub, which was seen briefly before flying out of view.	LD
SH002	24/06/2019		Sparrowhawk	1				Adult male flew from tree. Flew south B2 40s.possible nest in Sitka tree.	AOD

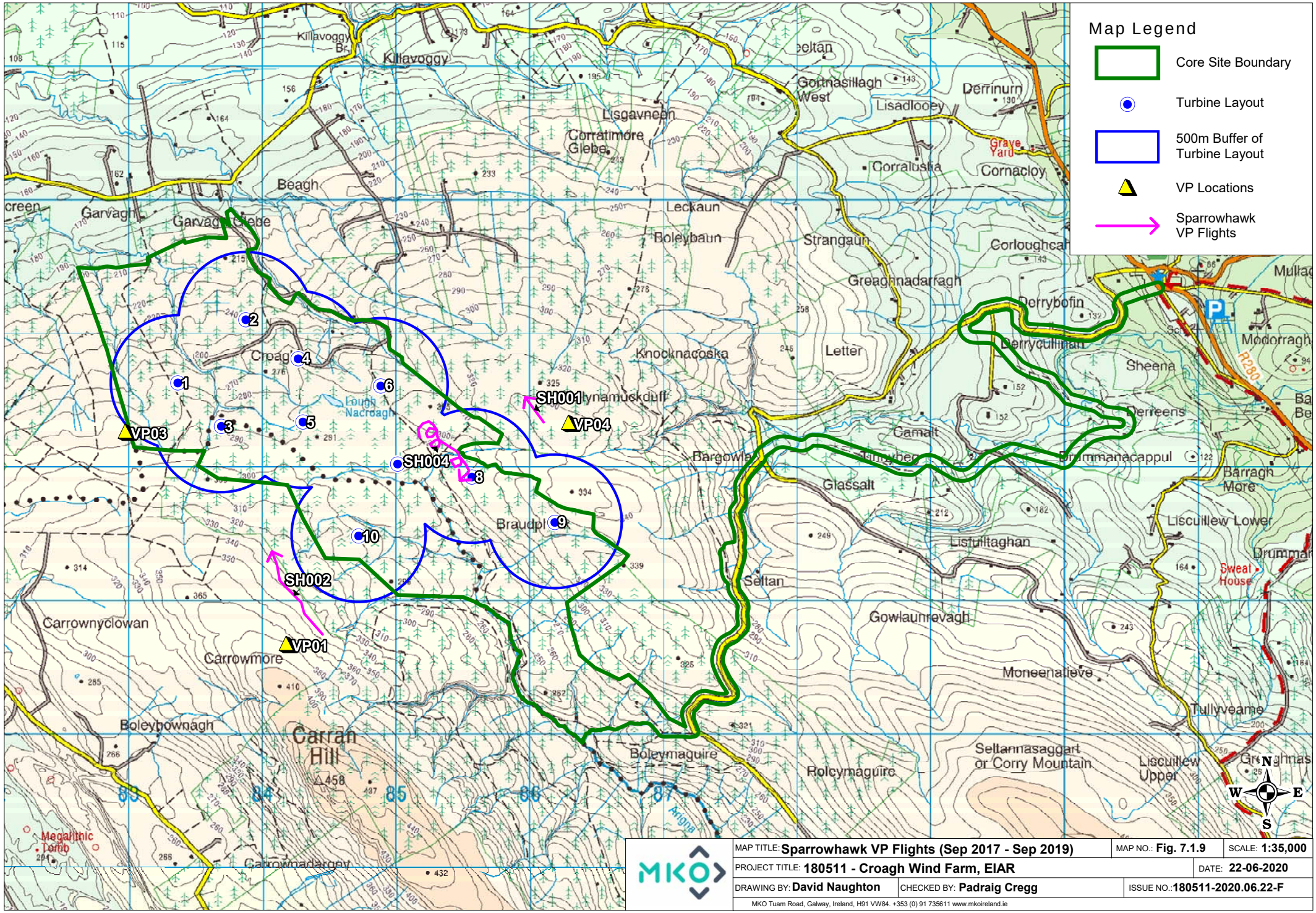
Table 1-30 Sparrowhawk Breeding Raptor Survey Data

Map Ref. No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
SH001	13/04/2018	VP_A	Sparrowhawk	1	15:37:00	13	GS4, (Wet grassland) WD4, (Conifer plantation) Flying	Sparrowhawk seen flying low over the ground, perched on a tree briefly (facing away) then flew off low again through the trees into the conifer plantation.	LD
SH002	19/04/2018	VP_B	Sparrowhawk	1	14:04:00	25	WD4, (Conifer plantation) Flying	Sparrowhawk also seen at VP-B flying long and low from west to east, over the conifers out of view.	LD

Map Ref. No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
SH003	08/05/2018	VP-A	Sparrowhawk	1	09:09:00	3	WD4, (Conifer plantation) Flying into and between trees.	Sparrowhawk seen again near VP-A around 75m south-west of the vantage point. Seen briefly flying through the conifers and out of view.	LD
SH004	12/05/2018	VP-B	Sparrowhawk	1	10:43:00	8	WD4, (Conifer plantation) GS4, (Wet grassland) Flying low.	Sparrowhawk seen flying low over (east) the conifers, being mobbed by a Hooded Crow, before landing in the trees and out of view.	LD
SH005	12/05/2018	N/A	Sparrowhawk	1	07:14:00	7	GS4, (Wet grassland) Flying low.	Sparrowhawk seen flying low over fields and grassland on the way to the VP.	LD
SH006	26/05/2018	VP-A	Sparrowhawk	1	08:32:00	5	GS4, (Wet grassland) WD4, (Conifer plantation) Flying low.	Sparrowhawk seen in flight parallel to a hillside and broadleaf trees, with conifers behind them. Flew from east to west out of view.	LD
SH007	17/07/2018	BRS	Sparrowhawk	2	13:08:00	220	WD4, (Conifer plantation) Pair soaring	Male and female	ED
SH008	18/07/2018	BRS	Sparrowhawk	1	14:10:00	50	WD4, (Conifer plantation) Male soaring	Adult Male	ED
SH009	19/07/2018	BRS	Sparrowhawk	1	11:40:00	35	WD4, (Conifer plantation) Female soaring	Female	ED
SH0010	22/05/2019	1	Sparrowhawk	1	10:35:00	35	WD4, (Conifer plantation) GS4, (Wet grassland) HH1, (Dry siliceous heath) Travelling and being mobbed.	Sparrowhawk seen shortly after, being mobbed by a Hooded Crow.	LD
SH0011	22/05/2019	1	Sparrowhawk	1	10:58:00	24	GS4, (Wet grassland) HH1, (Dry siliceous heath) Travelling.	Sparrowhawk seen again flying over the moorland and out of view into a section of conifers.	LD
SH0012	24/05/2019	1	Sparrowhawk	1	11:18:00	11	GS4, (Wet grassland) WD4, (Conifer plantation) Travelling, flying into trees.	Sparrowhawk seen in flight over conifers from VP9, before it landed in the trees and out of view.	LD
LD101	01/06/2019	6	Sparrowhawk	1	11:17:00	5	GS4, (Wet grassland) WD4, (Conifer plantation) Travelling	Brief view of a Sparrrowhawk flying over farmland through scrub.	LD

Table 1-31 Sparrowhawk Incidental Observations

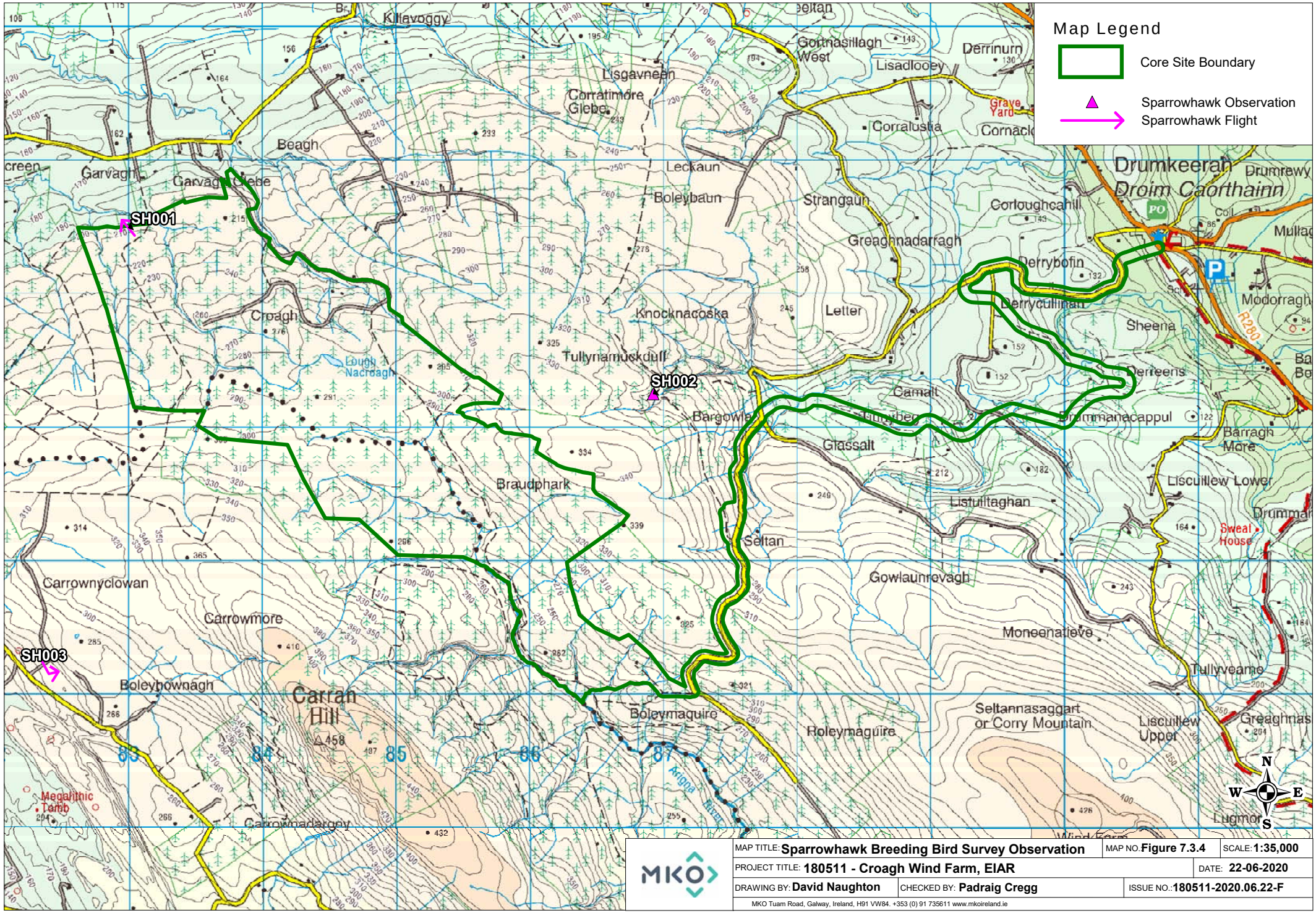
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	16/07/2019	Breeding Bird Survey	W	Sparrowhawk	1	Hunting. SH001	JK
	08/01/2019	Hen Harrier Roost Survey	2	Sparrowhawk	1	Hunting Blackbird	JK
	25/09/2017	Vantage Point Survey	Approx. Grid Ref G8520 2220	Sparrowhawk	1	Heard SH calling briefly in the distant conifer plantation at VP1	LD
	03/05/2018	Vantage Point Survey	VP6	Sparrowhawk	1	8:25 seen on break	SF



MAP TITLE: **Sparrowhawk VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.9**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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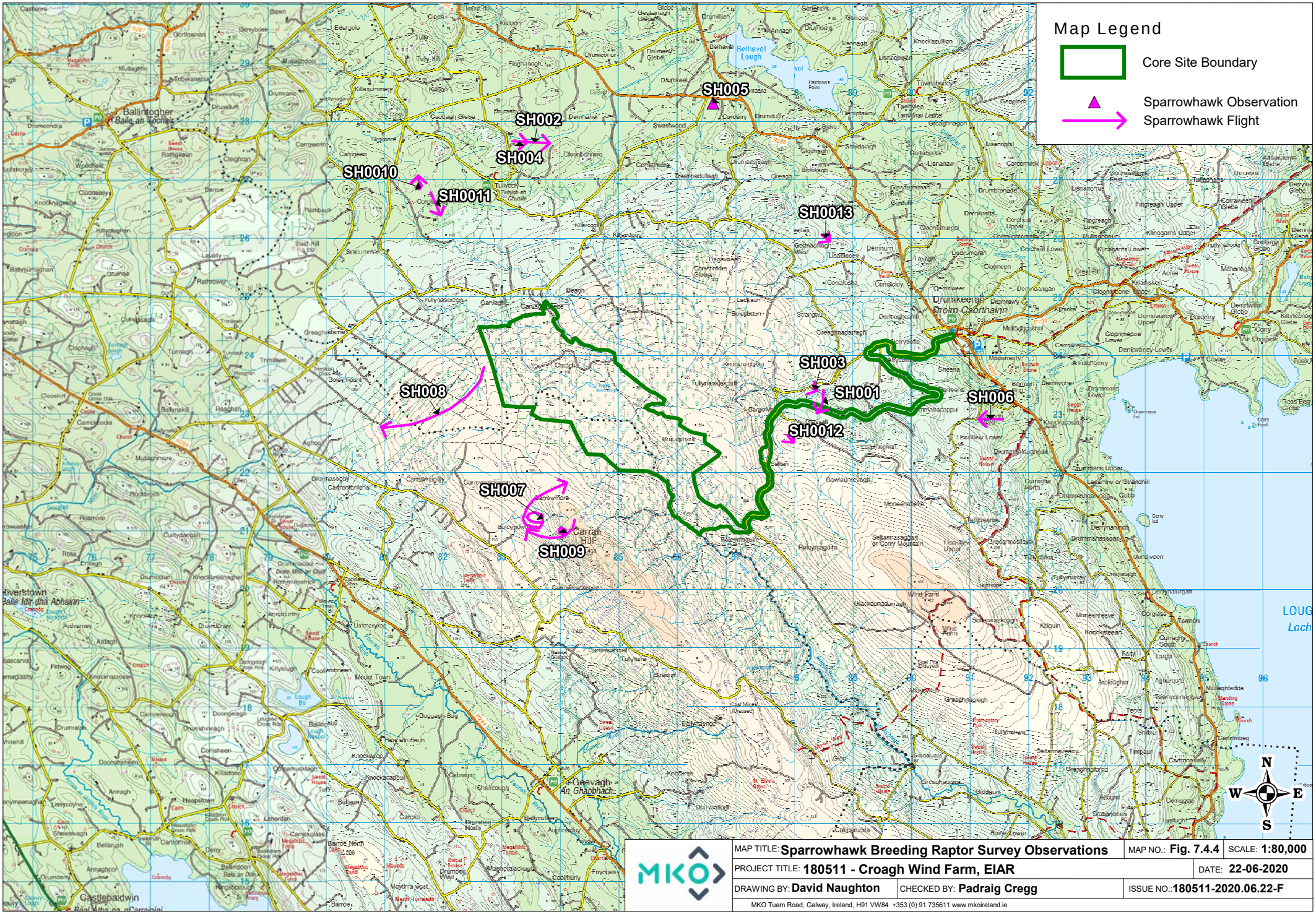
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MAP TITLE: **Sparrowhawk Breeding Bird Survey Observation**		MAP NO. **Figure 7.3.4**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**		ISSUE NO.: **180511-2020.06.22-F**

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MAP TITLE: **Sparrowhawk Breeding Raptor Survey Observations**		MAP NO.: **Fig. 7.4.4**	SCALE: **1:80,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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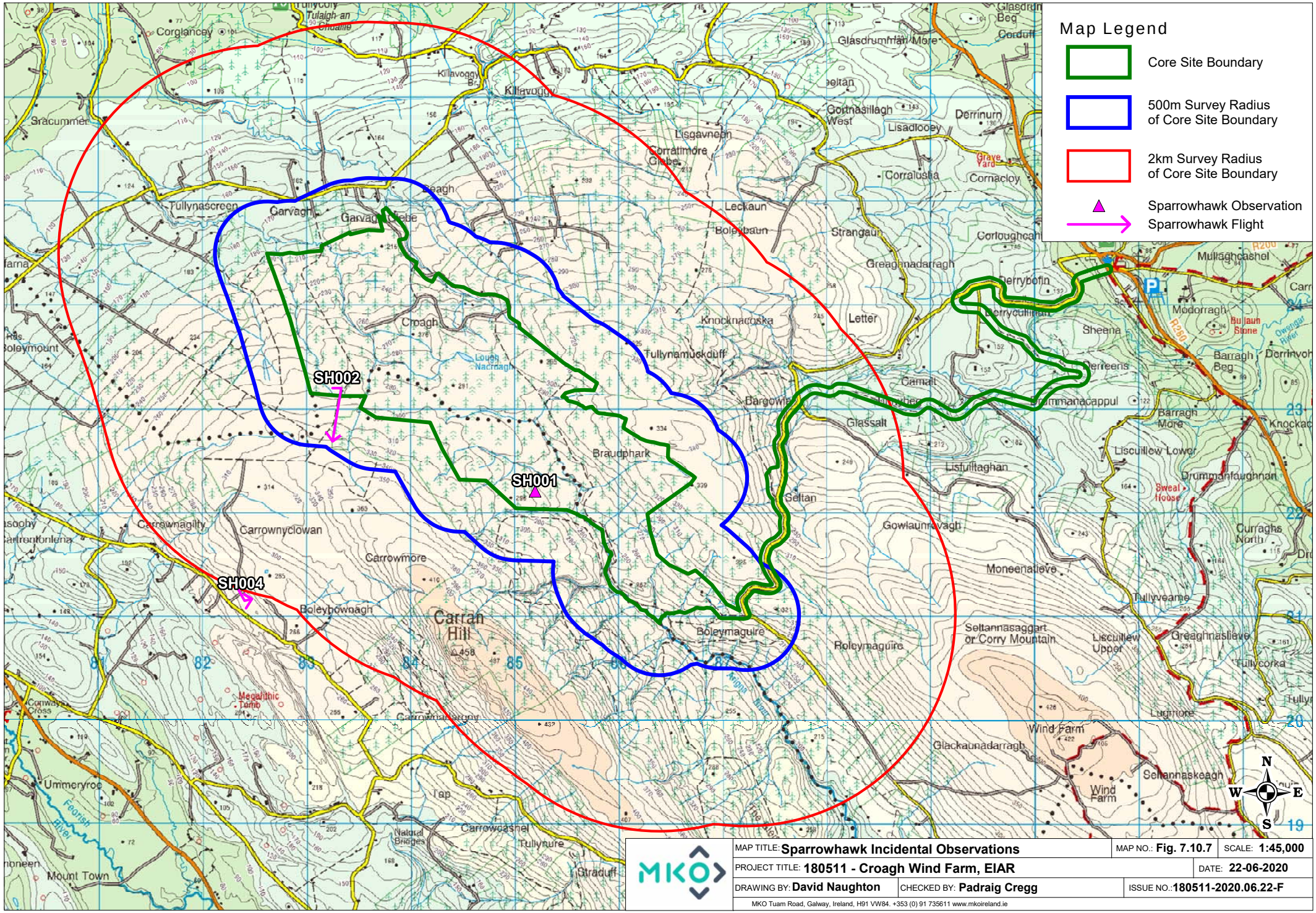

Map Legend
Core Site Boundary
500m Survey Radius of Core Site Boundary
2km Survey Radius of Core Site Boundary
Sparrowhawk Observation
Sparrowhawk Flight
SH001
SH002
SH004
Carran Hill
Croagh
Garvagh
Braudphark
Carrowmore
Carrownyclowan
Carrownagilly
Boleybownagh
Boleymaguire
Tullynamuskduff
Knocknacoska
Leckaun
Strangaun
Greaghnadarragh
Glassalt
Seltan
Gowlaunravagh
Moneenatieve
Seltannasaggart or Corry Mountain
Glackaunadarragh
Wind Farm
Carrowcashel
Tullynure
Graduff
Mount Town
Ummeryroe
Megalithic Tomb
Conway's Cross
Natural Bridges
Tullynascreen
Corglancey
Killavoggy
Lisgavneen
Corratimore Glebe
Derrinurn
Lisadooey
Corralustia
Cornacloy
Corloughcah
Derrybofin
Derryculliman
Sheena
Derreens
Carnalt
Bargowla
Lisfuiltaghan
Liscuillew Lower
Liscuillew Upper
Drummanfaughnan
Curraghs North
Greaghnasliave
Tullycorka
Tullyvearne
Lugmore
Mullaghcashel
Modorragh
Barragh Beg
Barragh More
Knockac
Derrinvoh
Letter
Tap
Feorish River
Owengar River
Sweat House
Grave Yard
Bullaun Stone
Glasdrumman Beg
Glasdrumman More
Corduff
Gortnasillagh West
Tullycolly
Tulaigh an Chuaille
Sracummer
Killavoggy Bg
Croagh Glebe
Garvagh Glebe
Boleybaun
Knocknacoska
Lough Nacroagh
Carrownagilly
Carrowmore
Boleybownagh
Boleymaguire
Seltan
Braudphark
Glassalt
Gowlaunravagh
Moneenatieve
Tullynamuskduff
Strangaun
Greaghnadarragh
Letter
Sheena
Derreens
Carnalt
Bargowla
Lisfuiltaghan
Liscuillew Lower
Drummanfaughnan
Curraghs North
Greaghnasliave
Tullycorka
Tullyvearne
Lugmore
Mullaghcashel
Modorragh
Barragh Beg
Barragh More
Derrinvoh
Knockac
Derrybofin
Derryculliman
Corloughcah
Cornacloy
Corralustia
Derrinurn
Lisadooey
Gortnasillagh West
Glasdrumman Beg
Glasdrumman More
Corduff
Killavoggy
Killavoggy Bg
Lisgavneen
Corratimore Glebe
Garvagh
Garvagh Glebe
Croagh
Tullynascreen
Sracummer
Corglancey
Tullycolly
Tulaigh an Chuaille
Braudphark
Carrowmore
Carrownyclowan
Carrownagilly
Boleybownagh
Boleymaguire
Carran Hill
458
Megalithic Tomb
Conway's Cross
Natural Bridges
Carrowcashel
Tullynure
Graduff
Mount Town
Ummeryroe
Feorish River
Tap
Wind Farm
Glackaunadarragh
Seltannaskeagh
Wind Farm
Seltannasaggart or Corry Mountain
Moneenatieve
Gowlaunravagh
Seltan
Glassalt
Braudphark
Tullynamuskduff
Knocknacoska
Lough Nacroagh
Leckaun
Boleybaun

Table 1-32 Kestrel Vantage Point Survey Data

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
K002	10/04/2018	3	Kestrel	1	11:06:00	130	130			136			PB4, (Cutover bog) HOVERING		SF
K003	21/06/2018	3	Kestrel	1	11:51:00	280			40	20	220		PB2, (Upland blanket bog) WD4, (Conifer plantation) PB4, (Cutover bog) Hunting over bog	Flew between 5-50m	RW
K004	21/06/2018	3	Kestrel	1	12:14:00	275				15	15	245	PB2, (Upland blanket bog) PB4, (Cutover bog) WD4, (Conifer plantation) Hunting over bog	Hunted between 5-30m	RW
K005	21/06/2018	3	Kestrel	1	12:30:00	157			15	15	34	245	PB2, (Upland blanket bog) PB4, (Cutover bog) WD4, (Conifer plantation) Hunting over bog	Flew at 5-50m	RW
K006	21/06/2018	3	Kestrel	1	12:32:00	54			5	5	10	34	WD4, (Conifer plantation) PB4, (Cutover bog) Hunting over bog	Flew up from bog and hovered up to 40m	RW
K007	21/06/2018	3	Kestrel	1	13:03:00	59			40	19			PB4, (Cutover bog) Hunting over bog	Flew at 2-40m	RW
K008	21/06/2018	3	Kestrel	1	15:04:00	47			17	30			PB2, (Upland blanket bog) PB4, (Cutover bog) Hunting over bog	Flew between 2-20m	RW
K009	21/06/2018	3	Kestrel	1	13:28:00	38			38				PB2, (Upland blanket bog) PB4, (Cutover bog) WD4, (Conifer plantation) Hunting over bog	Hunted below 10m then landed in tree	RW
K0010	21/06/2018	3	Kestrel	1	13:33:00	263			263				WD4, (Conifer plantation) PB2, (Upland blanket bog) PB4, (Cutover bog) Hunting over bog	Male took flight from tree and hunted below 10m	RW
K0011	21/06/2018	3	Kestrel	1	13:45:00	20			20				PB2, (Upland blanket bog) PB4, (Cutover bog) Hunting over bog	Seen only briefly during low hunting bout	RW

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
K0012	05/07/2018	4	Kestrel	1	12:03:00	21			21				PB2, (Upland blanket bog) WD4, (Conifer plantation) Flew along edge of forestry and landed	Male	RW
K0013	05/07/2018	4	Kestrel	1	15:38:00	280			99	126			PB2, (Upland blanket bog) WD4, (Conifer plantation) Hunting over bog	Male flew NW over bog and forestry	RW
K0014	27/08/2018	3	Kestrel	1	17:20:00	225	225				225		WD4, (Conifer plantation)	hunting	DM
K0015	01/11/2018	3	Kestrel	1	15:01:00	300	300	0		200	100		WD4, (Conifer plantation) PB2, (Upland blanket bog) Hunting	Adult male	AOD
K0016	25/03/2019	4	Kestrel	1	09:11:00	176			0	72	104	0	PB2, (Upland blanket bog) WD4, (Conifer plantation) Hovered over bog and rough ground at 15-30m, passing through turbines	adult male	RW
K0018	02/07/2019	3	Kestrel	1	14:25:00	360			30	330			PB4, (Cutover bog) WD4, (Conifer plantation) Hunting and hovering	Male	JK
K0020	04/09/2019	1	Kestrel	1	11:12:00	18	18	0		0	0		HH4, (Montane Heath)	Adult female foraging blown by wind low SW	AOD

Table 1-33 Kestrel Breeding Bird Survey Observations

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
K001	30/05/2018		Kestrel	1	13:16:00	5	GS4, (Wet grassland) WD4, (Conifer plantation) WS2, (Immature woodland) Flying into trees.	Kestrel seen briefly in flight outside the buffer when driving out. Approx. Grid Ref: G8190 2475.	LD

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
K002	12/07/2018		Kestrel	1	11:45:00		WD4, (Conifer plantation) PB2, (Upland blanket bog) Flushed from gap in forestry	Immature bird	RW
K003	17/04/2019	South-West	Kestrel	1	12:14:00		HH1, (Dry siliceous heath) GS4, (Wet grassland) WD4, (Conifer plantation) Travelling and hunting.	Saw a female Kestrel in flight from a short VP. The bird was flying west from open moorland, carrying an item of prey it had caught.	LD
K004	01/07/2019		Kestrel	1				Adult female hunting band2 120S mobbed by MP	AOD
K005	23/07/2019	SE	Kestrel	1			WD4, (Conifer plantation) Perched; flying	K002	JK
K006	23/07/2019	SE	Kestrel	1			WD4, (Conifer plantation) Perched; flying	K003	JK
K007	23/07/2019	SE	Kestrel	1			WD4, (Conifer plantation) Perched; flying	K004	JK

Table 1-34 Kestrel Breeding Raptor Survey Observations

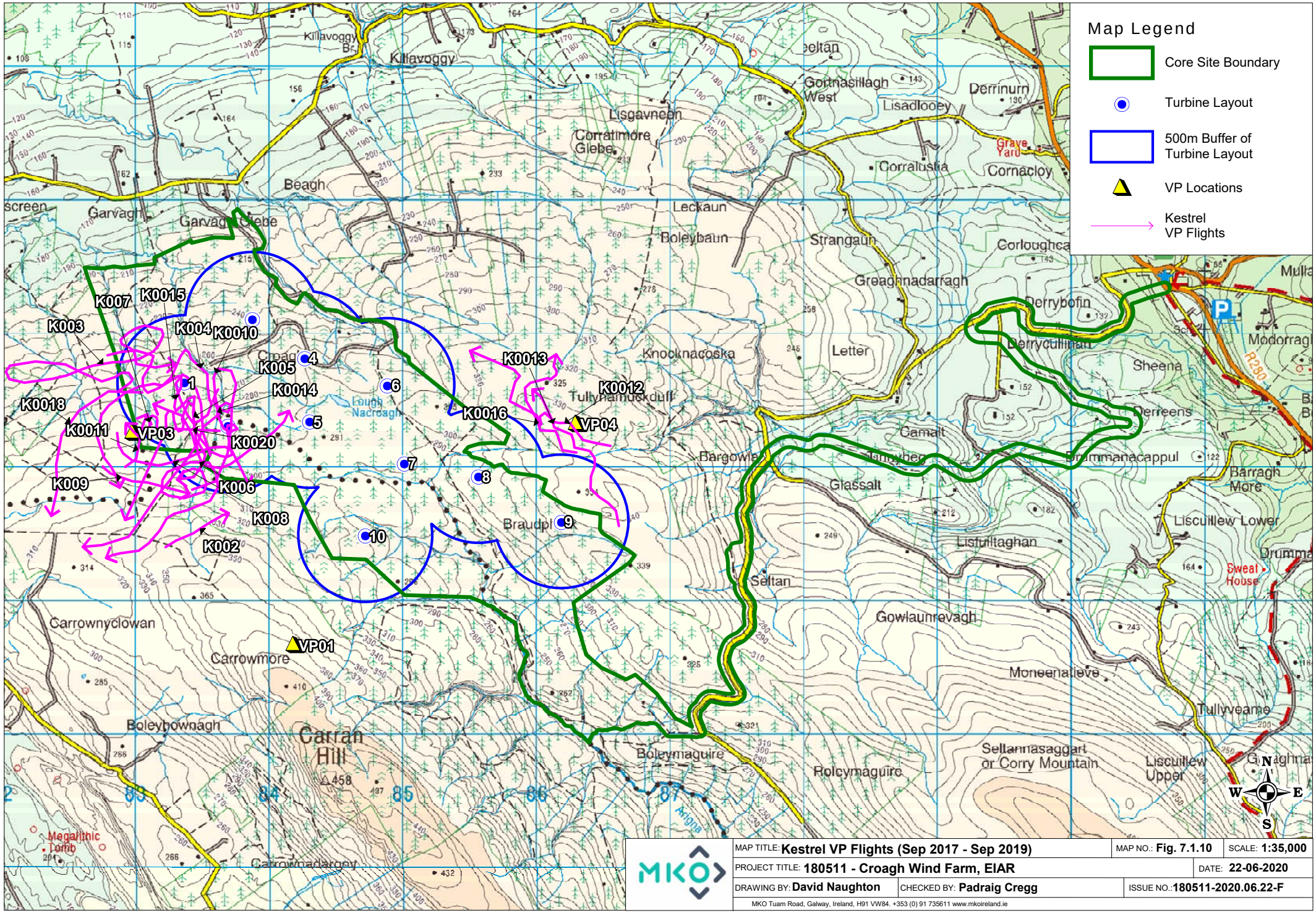
Map Ref. No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
K001	19/04/2018	VP_A	Kestrel	1	15:48:00	76	GS4, (Wet grassland) HH1, (Dry siliceous heath) Flying	Male Kestrel seen in flight, initially around 2-300m north and then flew overhead close by, heading south-east out of view.	LD
K002	19/04/2018	VP_A	Kestrel	1	15:50:00	61	GS4, (Wet grassland) HH1, (Dry siliceous heath) Flying	Female Kestrel see shortly after in the same area near VP-C. Flew and landed in the conifers, before heading off east.	LD
K003	22/04/2018	VP_B	Kestrel	1	11:17:00	4	GS4, (Wet grassland) HH4, (Montane heath) Flying to ground.	Kestrel seen very briefly flying low over dense grassland on a mountain slope. It disappeared behind some small trees into the grass. Not seen again and looked like a female from the brief view	LD
K004	12/05/2018	VP-C	Kestrel	1	08:27:00	6	GS4, (Wet grassland) HH1, (Dry siliceous heath) Flying low.	Kestrel seen flying low (west) over moorland, out of sight over a brow of a hill.	LD

Map Ref. No.	Date	RVP	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
K005	12/05/2018	VP-C	Kestrel	1	08:32:00	16	GS4, (Wet grassland) HH1, (Dry siliceous heath) WD4, (Conifer plantation) Hovering/Foraging	Kestrel seen again hovering and foraging, before flying east out of view.	LD
K006	17/05/2018	VP-B	Kestrel	1	11:24:00	7	GS4, (Wet grassland) HH1, (Dry siliceous heath) Flying low.	Kestrel seen briefly flying low over grass and heather into a small copse beside a narrow road. See map.	LD
K007	24/06/2018	VP-A	Kestrel	1	10:12:00	29	GS4, (Wet grassland) WD4, (Conifer plantation) (Mixed) broadleaved woodland Soaring	Kestrel seen in flight at VP-A. Flew from behind a hill over fields and farmland, then out of view over conifers. Heading south-east. See map for flight-line.	LD
K008	24/06/2018	VP-B	Kestrel	1	07:58:00	86	HH1, (Dry siliceous heath) GS4, (Wet grassland) (Mixed) broadleaved woodland Hovering and Flying	Kestrel seen in flight over an open area of moorland in the area where I've seen a pair foraging before. It flew up and hovered, before flying east out of view.	LD
K009	15/07/2018	BRS	Kestrel	1	12:42:00	80	WS5, (Recently-felled woodland) WD4, (Conifer plantation) Hunting	Adult Female	ED
K0010	19/07/2018	BRS	Kestrel	1	14:20:00	25	WD4, (Conifer plantation) WS5, (Recently-felled woodland) Hunting	Female	ED
K0011	19/07/2018	BRS	Kestrel	1	13:08:00	80	WD4, (Conifer plantation) Male perched before flying	Male	ED
LD103	02/06/2019	1	Kestrel	1	10:04:00	5	GS4, (Wet grassland) WD4, (Conifer plantation) In flight	Another brief sighting of a Kestrel, silhouetted by the sun, flying south/south-west behind a stand of conifers from VP1. Pair seen here last Spring and Summer.	LD
K0013	31/07/2019	9	Kestrel	1	17:25:00	20	WD4, (Conifer plantation) Hunting		JK

Table 1-35 kestrel Incidental Observations

Map Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	17/10/2018	Hen Harrier Roost Survey	HHVP3	Kestrel	1	Female adult hunting	AOD
	19/10/2018	Hen Harrier Roost Survey	HHVP2	Kestrel	1	Male flew into snipe flock	AOD
	11/12/2018	Hen Harrier Roost Survey	HHVP4	Kestrel	1	Hunting at edge of plantation	JK

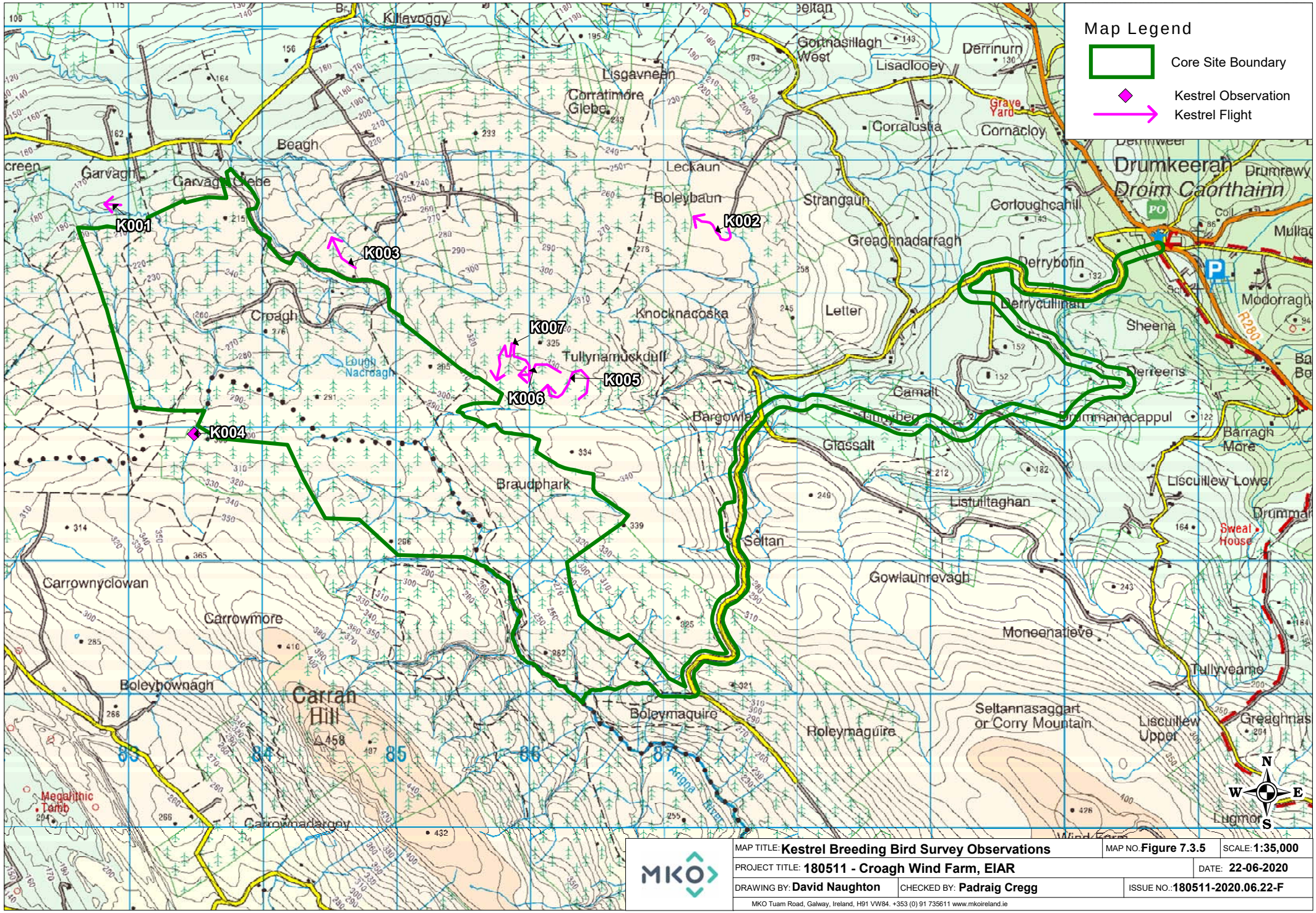
Map Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	10/01/2019	Hen Harrier Roost Survey	HHVP4	Kestrel	1	Hunting	JK



MAP TITLE: **Kestrel VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.10**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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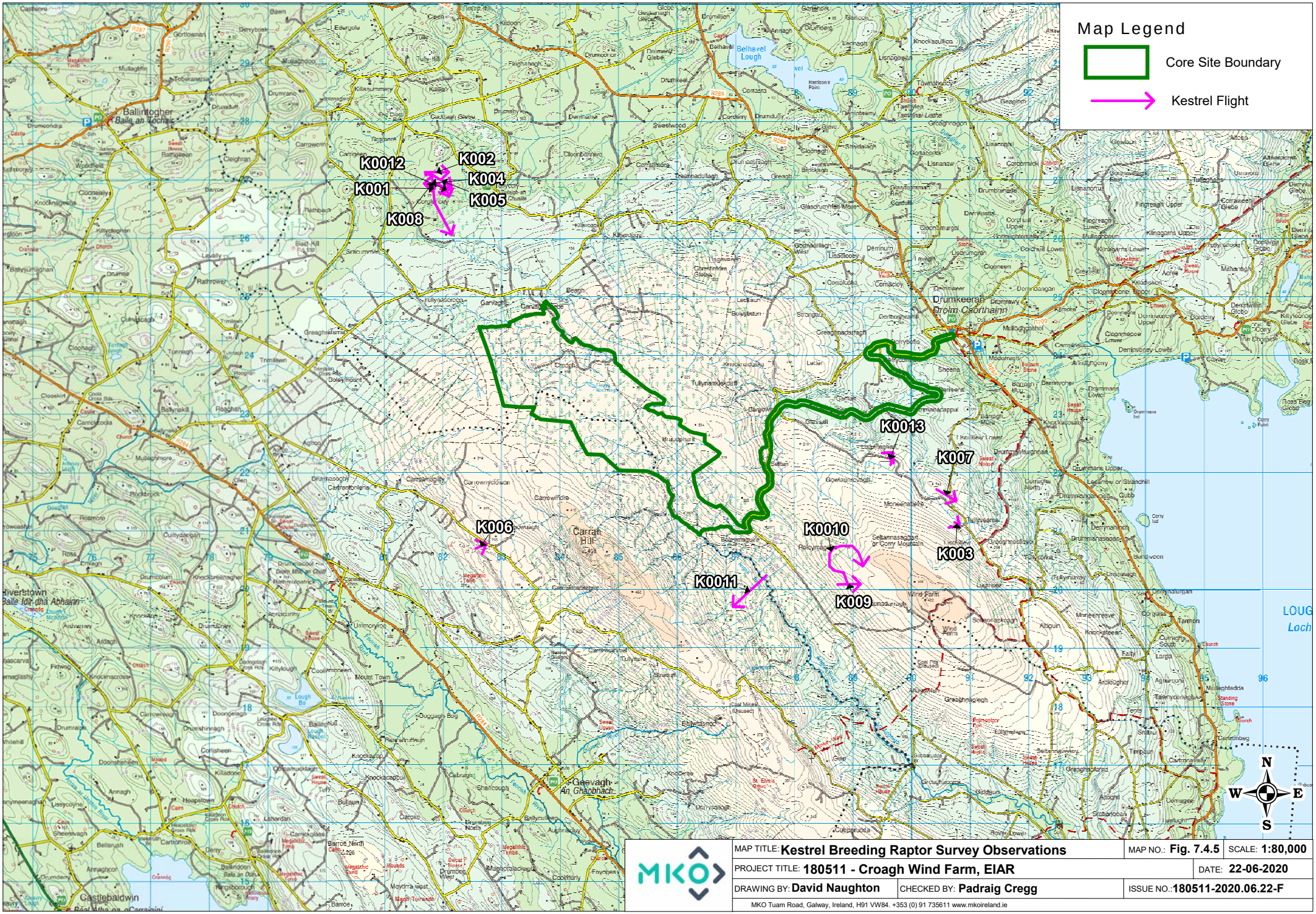
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MAP TITLE: **Kestrel Breeding Bird Survey Observations**	MAP NO. **Figure 7.3.5**	SCALE: **1:35,000**
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DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.22-F**

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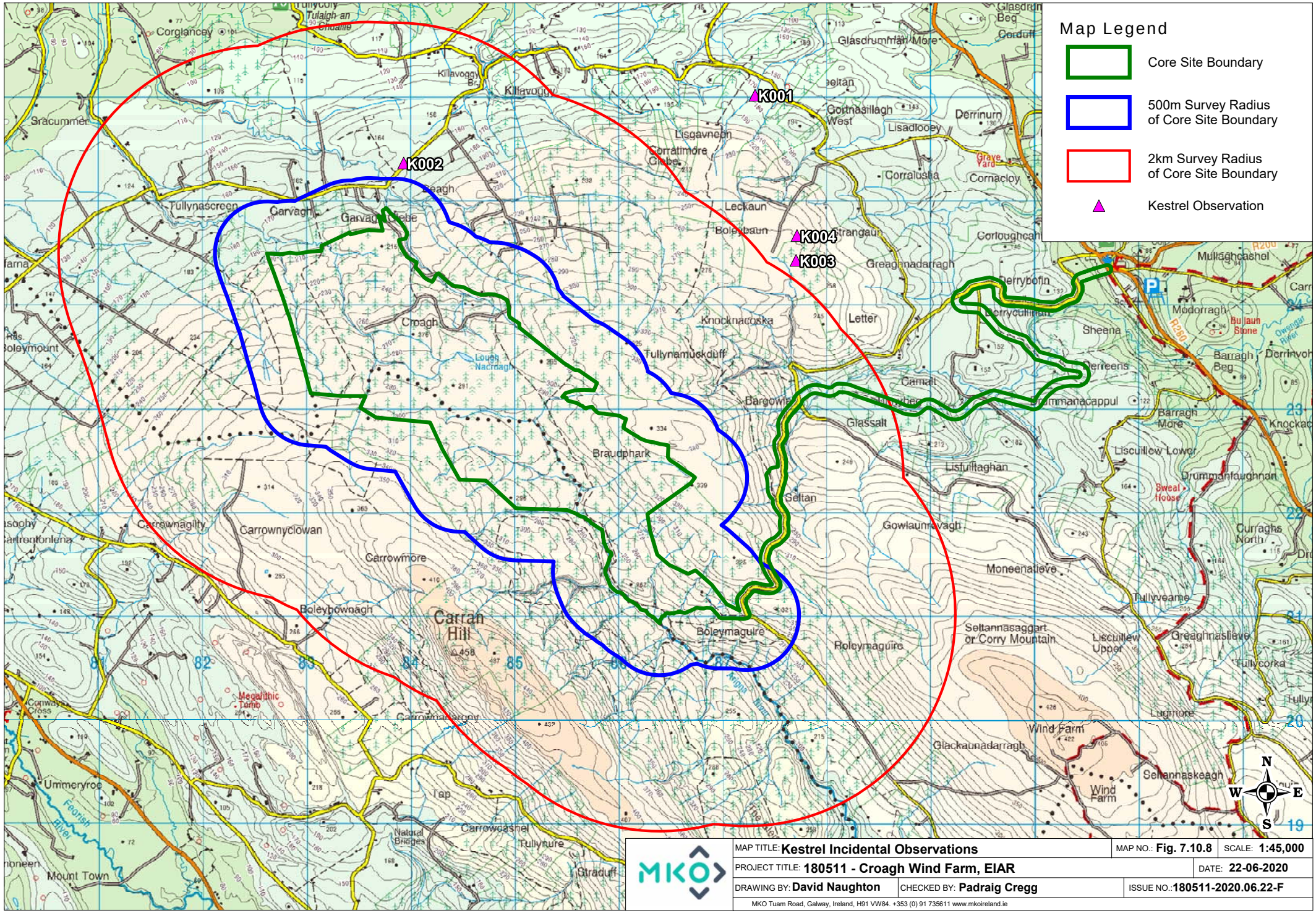
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MAP TITLE: **Kestrel Breeding Raptor Survey Observations**		MAP NO.: **Fig. 7.4.5**	SCALE: **1:80,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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MAP TITLE: **Kestrel Incidental Observations**		MAP NO.: **Fig. 7.10.8**	SCALE: **1:45,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
DRAWING BY: **David Naughton**	CHECKED BY: **Padraig Cregg**		ISSUE NO.: **180511-2020.06.22-F**

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Table 1-36 Snipe Vantage Point Survey Flights

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
SN001	20/12/2017	1	Snipe	1	09:20:00	30			30				PB2, (Upland blanket bog) flushed from heath		DM
SN002	17/09/2018	3	Snipe	1	10:40:00	70	30	40			70		PB2, (Upland blanket bog) travelling		DM
SN003	18/09/2018	1	Snipe	1	06:35:00	30		30		30			PB2, (Upland blanket bog) flushed off bog at dawn		DM
SN004	23/10/2018	1	Snipe	1	12:55:00	3		3	3				WD4, (Conifer plantation) Flushed at VP		AOD
SN005	30/04/2019	1	Snipe	1	15:18:00	10	0	10	3	7			HH4, (Montane heath) Chipping in flight		AOD
SN006	30/04/2019	1	Snipe	1	19:34:00	1800	800	1000		1800			HH4, (Montane heath) Drumming	Male	AOD
SN007	17/05/2019	1	Snipe	1	11:46:00	30	0	30	15	15			HH4, (Montane heath) Chipping in flight	Adult	AOD
SN008	17/05/2019	1	Snipe	1	12:02:00	640	500	140	400	240			HH4, (Montane heath) Chipping in flight	Adult	AOD
SN009	14/06/2019	3	Snipe	2	16:27"33	67	60	7		7	60		HH1, (Dry siliceous heath) Drumming and flying, joined by a second SN, both disappeared behind the ridge. Saw and heard.		PW
SN0010	18/06/2019	1	Snipe	1	12:18:00	210		210		27	183		HH1, (Dry siliceous heath) Drumming SN heard and seen displaying over moorland up and down in erratic flight.		PW
SN0011	18/06/2019	1	Snipe	2	15:11"30	600		600		200	400		HH1, (Dry siliceous heath) 2 SN drumming/displaying over HH1 over wide area. One bird was followed for 10 minutes.		PW

Table 1-37 Snipe Vantage Point Survey Non-Visual Observations

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
SN001	10/04/2018	3	Common Snipe	1	10:58:00	PB4, (Cutover bog) Snipe call		SF
SN002	10/04/2018	3	Common Snipe	1	11:39:00	PB4, (Cutover bog) Snipe calling		SF
SN003	10/04/2018	3	Common Snipe	1	11:51:00	PB4, (Cutover bog)		SF
SN004	02/05/2018	1	Common Snipe	1	07:20:00	PB2, (Upland blanket bog) Calling	Calling no flight	SF
SN005	02/05/2018	1	Common Snipe	1	06:43:00	PB2,WD4		SF
SN006	03/05/2018	3	Common Snipe	1	05:32:00	PB2, (Upland blanket bog) WD4, (Conifer plantation) Calling		SF
SN007	29/04/2019	3	Common Snipe	4	21:36:00	HH4, (Montane heath) GS4, (Wet grassland) 4 Chipping	4 Chipping	AOD
SN008	30/04/2019	1	Common Snipe	4	21:32:00	HH4, (Montane heath) PB2, (Upland blanket bog) 3 Chipping 1 Drumming	3 Chipping 1 Drumming	AOD
SN009	15/05/2019	1	Common Snipe	1	05:00:00	HH4, (Montane heath) Drumming male		AOD
SN010	13/06/2019	4	Common Snipe	1	19:40:00	HH1, (Dry siliceous heath) Chipping, heard not seen.		PW
SN011	14/06/2019	3	Common Snipe	1	16:33:00	WD4, (Conifer plantation) Heard, not seen		PW
SN012	18/06/2019	1	Common Snipe	1	11:07:00	HH1, (Dry siliceous heath) Chipping, heard not seen.		PW
SN013	18/06/2019	1	Common Snipe	1	11:45:00	HH1, (Dry siliceous heath) Drumming SN heard over moorland behind VP1, not seen.		PW
SN014	18/06/2019	1	Common Snipe	1	11:53:00	HH1, (Dry siliceous heath) Drumming SN heard over moorland behind VP1, not seen.		PW
SN015	18/06/2019	1	Common Snipe	1	14:16"17	HH1, (Dry siliceous heath) Drumming SN heard over moorland behind VP1, not seen.		PW

Table 1-38 Snipe Breeding Bird Survey Observations

Map Ref. No.	Date	Transect	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
SN001	26/04/2018	West	Snipe	1			GS4, (Wet grassland) HH1, (Dry siliceous heath) Flushed	flushed from dense grass during the Walkover.	LD
SN002	26/04/2018	West	Snipe	2			GS4, (Wet grassland) HH1, (Dry siliceous heath) Flushed	two together at G 8335 2290.	LD
SN003	26/04/2018	West	Snipe	1			GS4, (Wet grassland) HH1, (Dry siliceous heath) flight		LD
SN004	10/07/2018		Snipe	1	12:19:00		WD4, (Conifer plantation) Flushed from rotation	Adult	RW
SN005	10/07/2018		Snipe	1	12:14:00		WD4, (Conifer plantation) Flushed from rotation	Adult	RW
SN006	21/05/2019	SW	Snipe	1	11:37:00		Drumming in display flight.	Snipe seen drumming in the northern section of the site, in display.	LD
SN007	21/05/2019	SW	Snipe	1	11:51:00		Drumming in display flight.	As above. Snipe seen drumming in the northern section of the site, in display again in the same area.	LD
SN008	24/06/2019		Snipe	1				Chipping unseen	AOD
SN009	01/07/2019		Snipe	1				Chipping and flew 3s B1	AOD

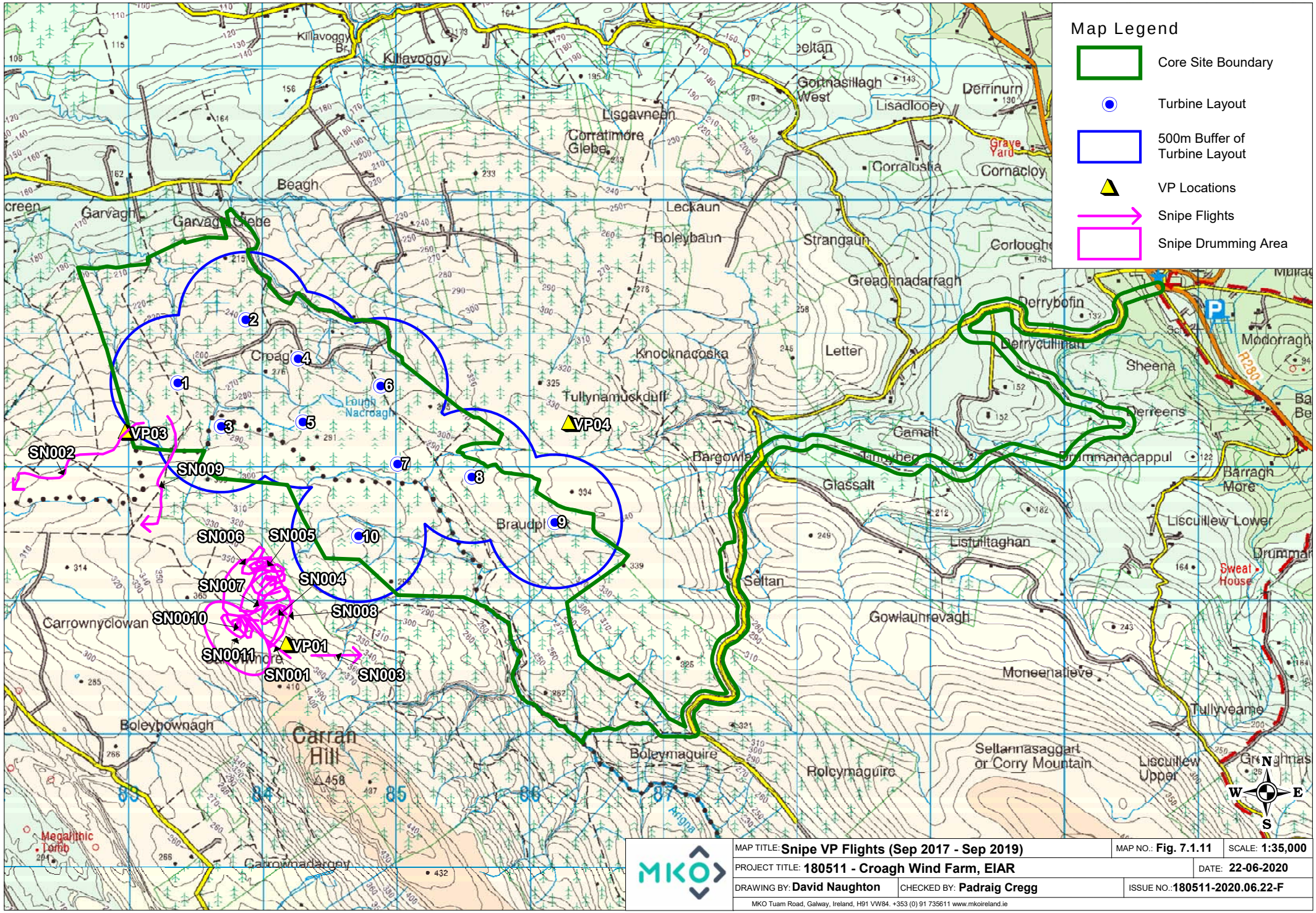
Table 1-39 Snipe Incidental Observations

Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	07/05/2019	Breeding Raptor Survey	10	Snipe	1	Snipe seen drumming in display flight from VP 10.	LD
	07/05/2019	Breeding Raptor Survey	10	Snipe	1	Snipe seen drumming in display flight from VP 10.	LD

Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	09/05/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping in the same location on and off near VP 3.	LD
	09/05/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping in the same location on and off near VP 3.	LD
	09/05/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping in the same location on and off near VP 3.	LD
	09/05/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping in the same location on and off near VP 3.	LD
	09/05/2019	Breeding Raptor Survey	3	Snipe	2	Snipe seen drumming in display flight from VP 3 to the south-east of the bird chipping. Two Snipe present.	LD
	03/06/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping on and off, on three occasions in wet grassland to the north-west of VP3.	LD
	03/06/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping on and off, on three occasions in wet grassland to the north-west of VP3.	LD
	03/06/2019	Breeding Raptor Survey	3	Snipe	1	A second Snipe was later seen drumming in display flight over heather moorland, further to the east. See map for both birds locations.	LD
	03/06/2019	Breeding Raptor Survey	3	Snipe	1	A second Snipe was later seen drumming in display flight over heather moorland, further to the east. See map for both birds locations.	LD
	03/06/2019	Breeding Raptor Survey	3	Snipe	1	Snipe heard chipping on and off, on three occasions in wet grassland to the north-west of VP3.	LD
	03/06/2019	Breeding Raptor Survey	5	Snipe	1	Another Snipe was then seen drumming from VP5, flying above an area of wet grassland after chipping on and off for a while. See map for species locations.	LD

Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	03/06/2019	Breeding Raptor Survey	5	Snipe	1	Another Snipe was then seen drumming from VP5, flying above an area of wet grassland after chipping on and off for a while. See map for species locations.	LD
	03/06/2019	Breeding Raptor Survey	5	Snipe	1	Another Snipe was then seen drumming from VP5, flying above an area of wet grassland after chipping on and off for a while. See map for species locations.	LD
	04/06/2019	Breeding Raptor Survey	10	Snipe	1	Heard a Snipe chipping in reeds and rough grassland on the hillside above VP 10, which then began drumming in display flight a while later. This was in the same location the bird was observed during the last survey.	LD
	04/06/2019	Breeding Raptor Survey	10	Snipe	1	Heard a Snipe chipping in reeds and rough grassland on the hillside above VP 10, which then began drumming in display flight a while later. This was in the same location the bird was observed during the last survey.	LD
SN005	14/04/2018	Breeding Raptor Survey	Carran Hill	Snipe	1	Snipe 'Chipping' in wet grassland and Juncus close to VP-B. Approx. Grid Ref: G 8970 2795.	LD
SN006	23/04/2018	Breeding Raptor Survey	Carran Hill	Snipe	1	Snipe 'Chipping' in wet grassland and wet reeds close to VP-A. Approx. Grid Ref: G 8095 2500.	LD
SN007	07/05/2018	Breeding Raptor Survey	Carran Hill VP- A	Snipe	1	Snipe flushed from a track near VP-A at G 8055 2480.	LD
	08/07/2019	Breeding Raptor Survey	BRS4	Snipe		Probes (Little holes left behind after feeding)	JK
SN002	23/10/2017	Hen Harrier Roost Survey	Near HH01	Snipe	2	Flushed at about G/82415/21820, OOS.	CP
	18/12/2017	Hen Harrier Roost Survey	HHVP1	Snipe	1	Flew off bog to feed, at 16:45	DM

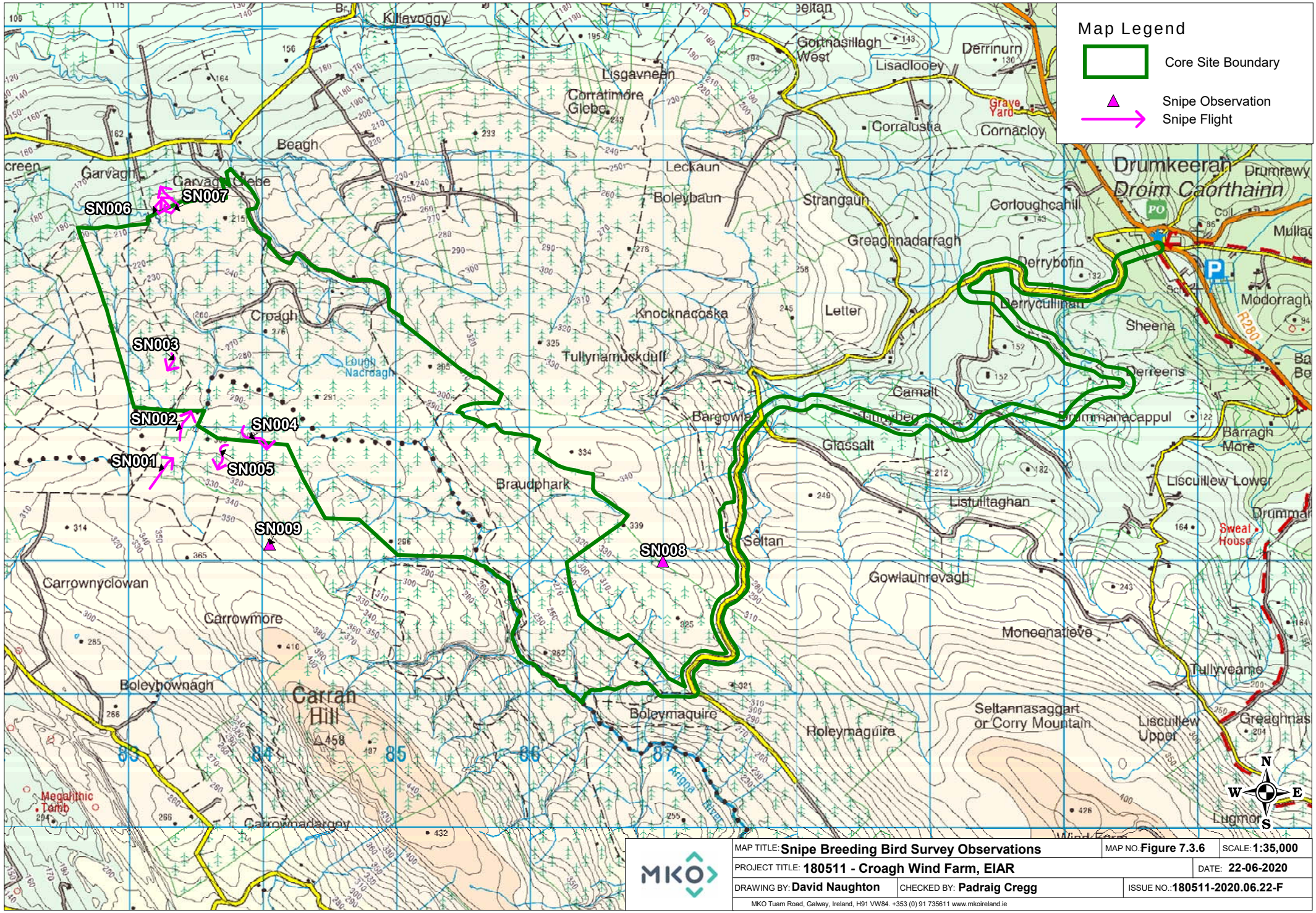
Ref. No.	Date	Survey Type	Location	Species	No. of Individuals	Notes	Surveyor
	19/10/2018	Hen Harrier Roost Survey	HHVP2	Snipe	12	Flock flying	AOD
	11/12/2018	Hen Harrier Roost Survey	4	Snipe	1	Call heard	JK
	03/01/2019	Hen Harrier Roost Survey	3	Snipe	1	Call heard.	JK
SN001	25/09/2017	Vantage Point Survey	Approx. Grid Ref G8370 2215	Snipe	1	Flushed Snipe on way to VP1	LD
SN004	25/01/2018	Vantage Point Survey	VP1	Snipe	1	Flushed a Snipe on the way in to the VP. Grid Ref: G 8372 2195.	LD
	29/04/2019	Vantage Point Survey	VP 3	Snipe	max 4	Drumming and chipping	AOD
	30/04/2019	Vantage Point Survey	VP 1	Snipe	max 4	Drumming and chipping	AOD
	14/05/2019	Vantage Point Survey	3	Snipe	max 1	Drumming	AOD
	15/05/2019	Vantage Point Survey	1	Snipe	max 1	Drumming	AOD
	16/05/2019	Vantage Point Survey	4	Snipe	max1	Chipping	AOD
	17/05/2019	Vantage Point Survey	2	Snipe	max2	Chipping	AOD
	04/09/2019	Vantage Point Survey	VP1	Snipe	2	Calling until light	AOD
	05/09/2019	Vantage Point Survey	VP3	Snipe	1	Calling until light	AOD
SN0015	13/06/2019	Woodcock Survey	2	Snipe	1	Drumming bird heard only. IG86153 25777	PW



MAP TITLE: **Snipe VP Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 7.1.11**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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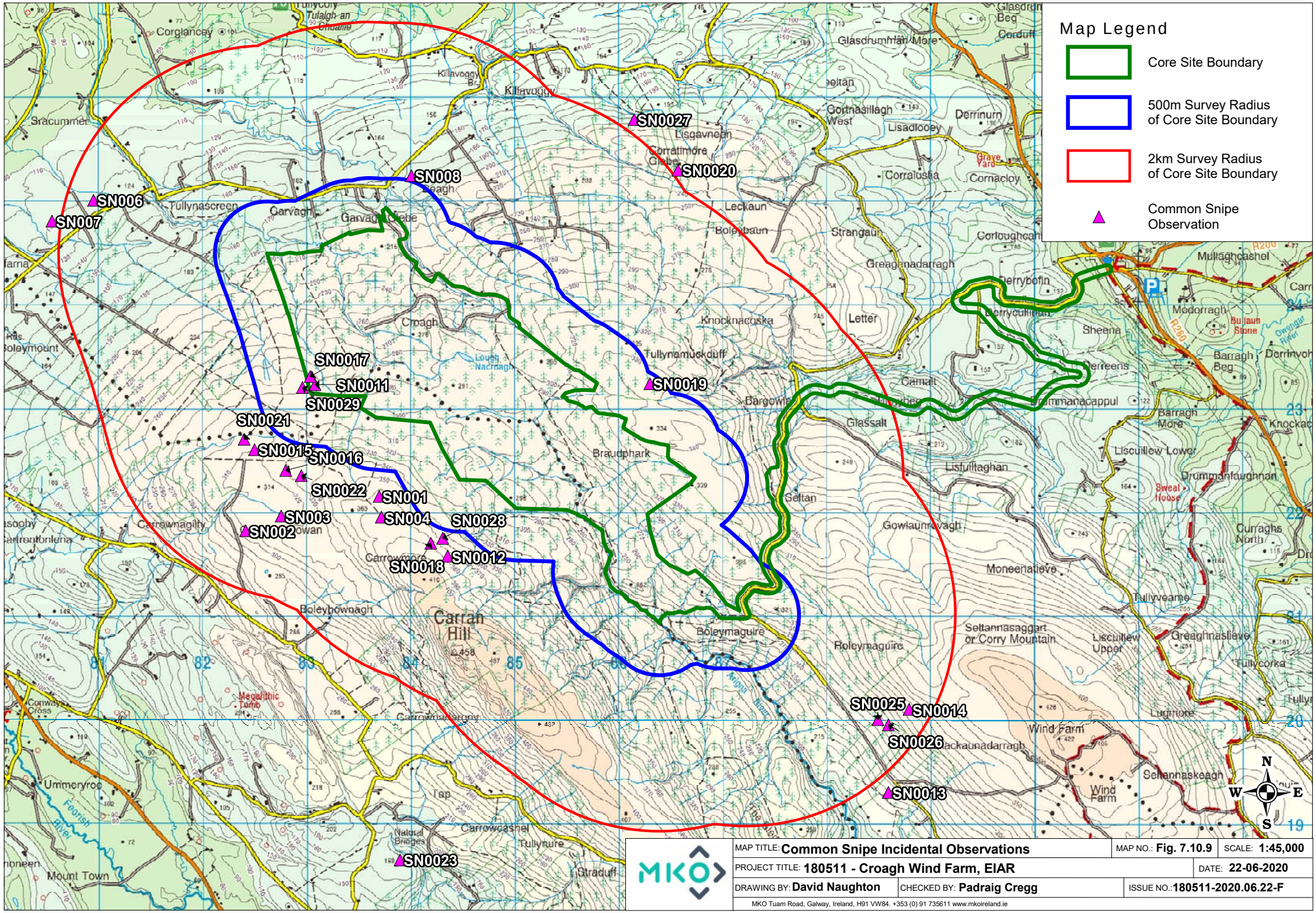
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MAP TITLE: **Snipe Breeding Bird Survey Observations**		MAP NO. **Figure 7.3.6**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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MAP TITLE: **Common Snipe Incidental Observations**		MAP NO.: **Fig. 7.10.9**	SCALE: **1:45,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **22-06-2020**
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Appendix 7-5 – Additional Survey Data

Croagh Windfarm

DOCUMENT DETAILS

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Project Title:	**Croagh Windfarm**
Project Number:	**180511**
Document Title:	**Appendix 7-5 – Additional Survey Data**
Document File Name:	**180511 – EIAR – 2019.09.19 – D1**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

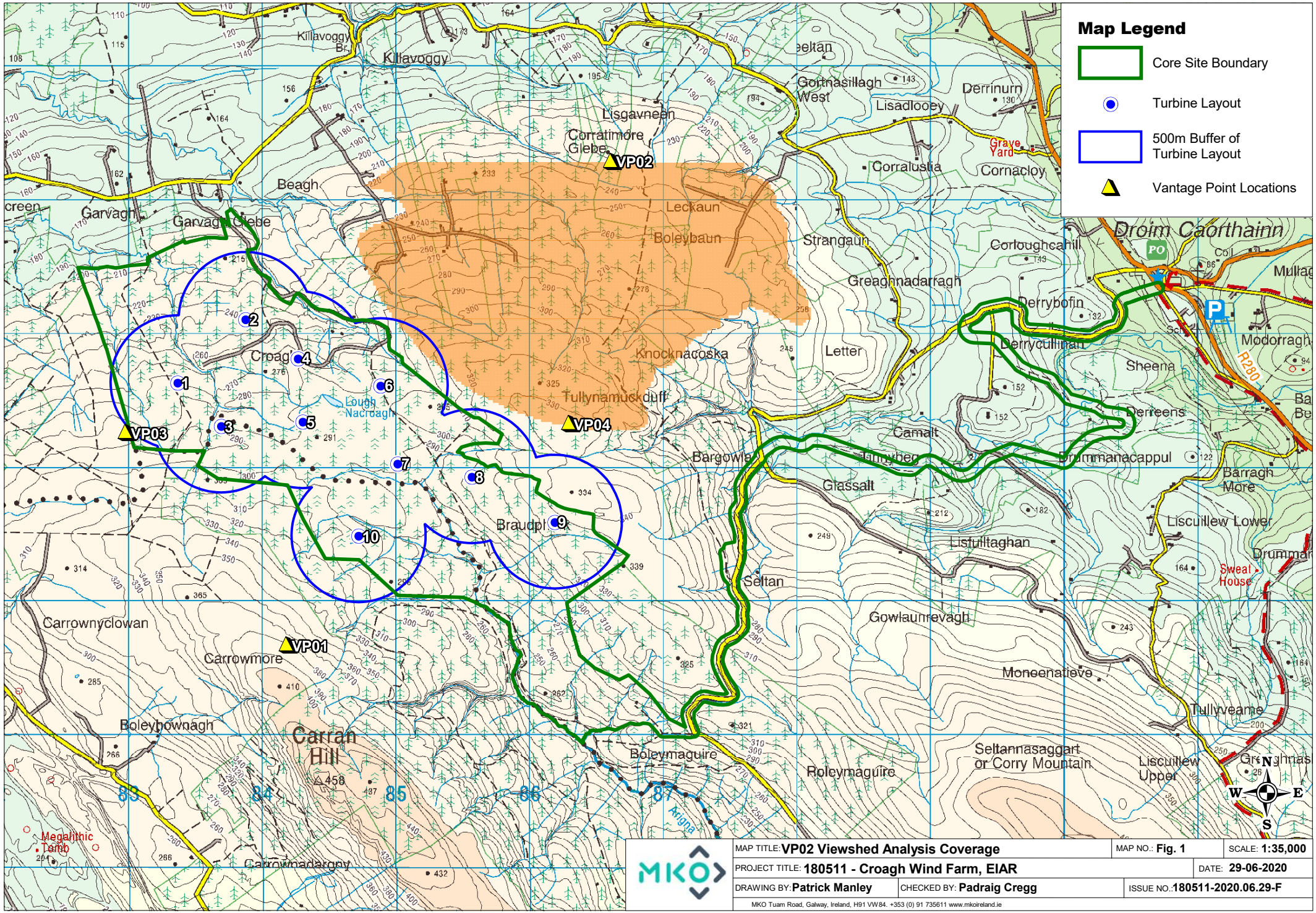
Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	19/09/2019	DN	PC
02	Final	29/06/2020	DN/PM	PC

Table of Contents

TABLE OF TABLES

Table 1-1 Golden Plover VP2 Survey Data (Boleybaun) 2
Table 1-2 Hen Harrier VP2 Survey Data (Boleybaun) 3
Table 1-3 Merlin Breeding Bird Survey Observation from Boleybaun Area 4
Table 1-4 Red Grouse VP2 Survey Data (Boleybaun) 5
Table 1-5 Buzzard VP2 Survey Data (Boleybaun) 6
Table 1-6 Sparrowhawk VP2 Survey Data (Boleybaun) 7
Table 1-7 Kestrel VP2 Survey Data (Boleybaun) 8
Table 1-8 Kestrel Winter Transect Survey Observation from Boleybaun Area 8



MAP TITLE: **VP02 Viewshed Analysis Coverage**		MAP NO.: **Fig. 1**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
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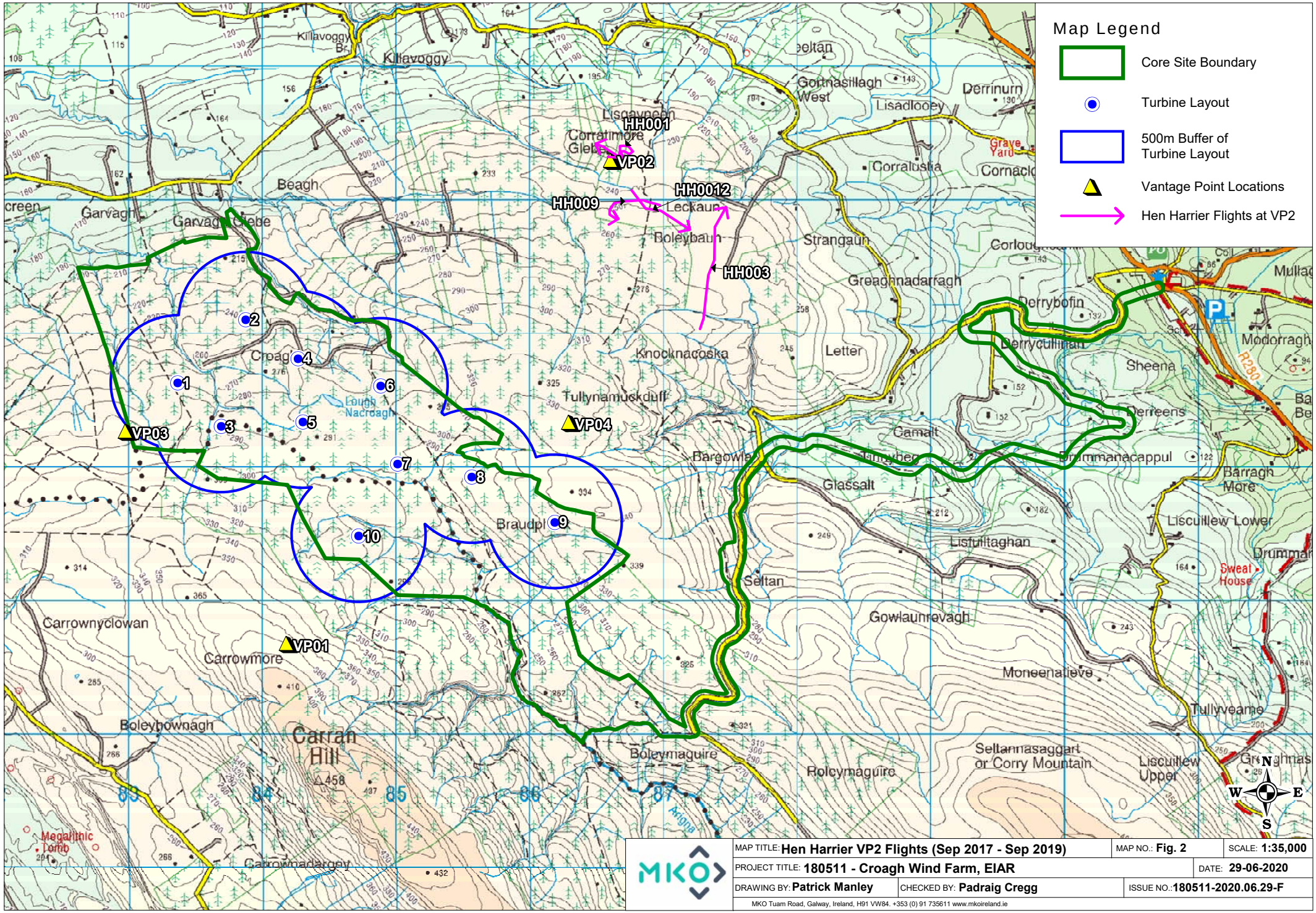
1. APPENDIX 7-5 (ADDITONIAL SURVEY DATA)

Table 1-1 Golden Plover VP2 Survey Data (Boleybaun)

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
N/A	14/11/2017	2	Golden Plover	1	15:17:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Golden Plover heard calling two or three times, around 100-150m south east of the VP in the heather.	LD
N/A	14/11/2017	2	Golden Plover	1	15:24:00	HH1, (Dry siliceous heath) GS4, (Wet grassland) Calling	Golden Plover heard calling again (9-11 secs) from the same area above. Approximate Grid Ref: G 8700 2505.	LD
N/A	07/11/2018	2	Golden Plover	1	07:10:00	PB4, (Cutover bog) Call heard of lone bird		JK

Table 1-2 Hen Harrier VP2 Survey Data (Boleybaun)

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
HH001	22/02/2018	2	Hen Harrier	1	12:31:00	37			25	12			PB2, (Upland blanket bog) WD4, (Conifer plantation) Ringtail circled up over plantation finger at 5-20m before heading E out of sight	Ringtail	RW
HH003	04/05/2018	2	Hen Harrier	1	09:25:00	15			15				WD4, (Conifer plantation) in flight		SF
HH009	19/09/2018	2	Hen Harrier	1	14:00:00	50	50			50			PB2, (Upland blanket bog) hunting female/juv		DM
HH0012	03/09/2019	2	Hen Harrier	1	08:39:00	8	0	8		0	0		WD4, (Conifer plantation)	Juvenille HH flying low towards site	AOD



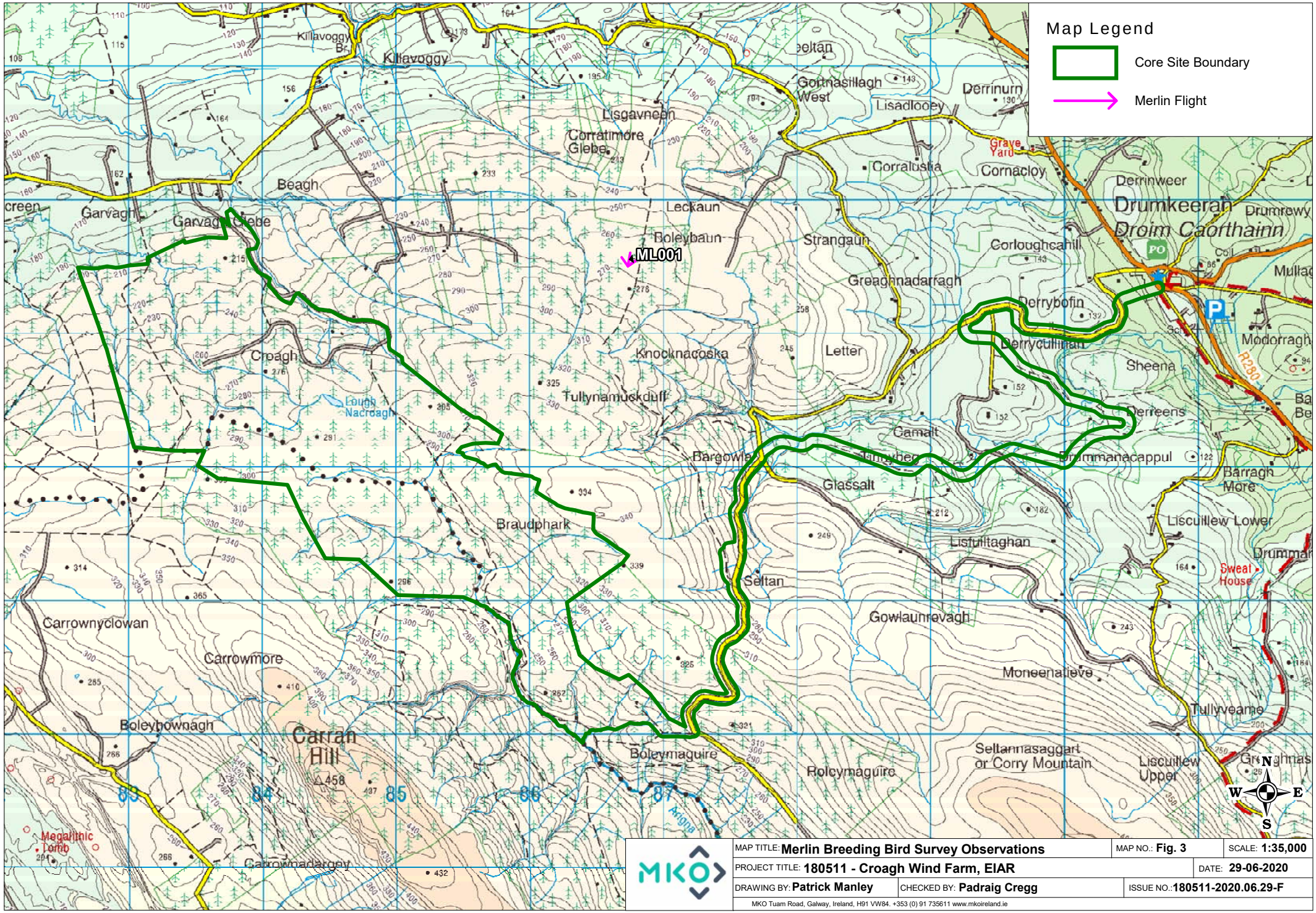
MAP TITLE: **Hen Harrier VP2 Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 2**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
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Table 1-3 Merlin Breeding Bird Survey Observation from Boleybaun Area

Map Ref. No.	Date	Transect/ Area	Species	No. of Birds	Time of flight	Duration of flight (s)	Notes on habitat and activity	Comments	Surveyor
ML001	06/05/2018		Merlin	1	08:32:00	5	GS4, (Wet grassland) WD4, (Conifer plantation) WS2, (Immature woodland) Flying into trees.	Possible Merlin seen flying low over heather, dense grass and immature conifers into a large conifer. Brief sighting (4-5 seconds) so cannot be certain as it flew south into the sun. Silhouette of a Falcon and suitable habitat at the edge of conifers, with open moorland adjacent for foraging.	LD



MAP TITLE: **Merlin Breeding Bird Survey Observations**		MAP NO.: **Fig. 3**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
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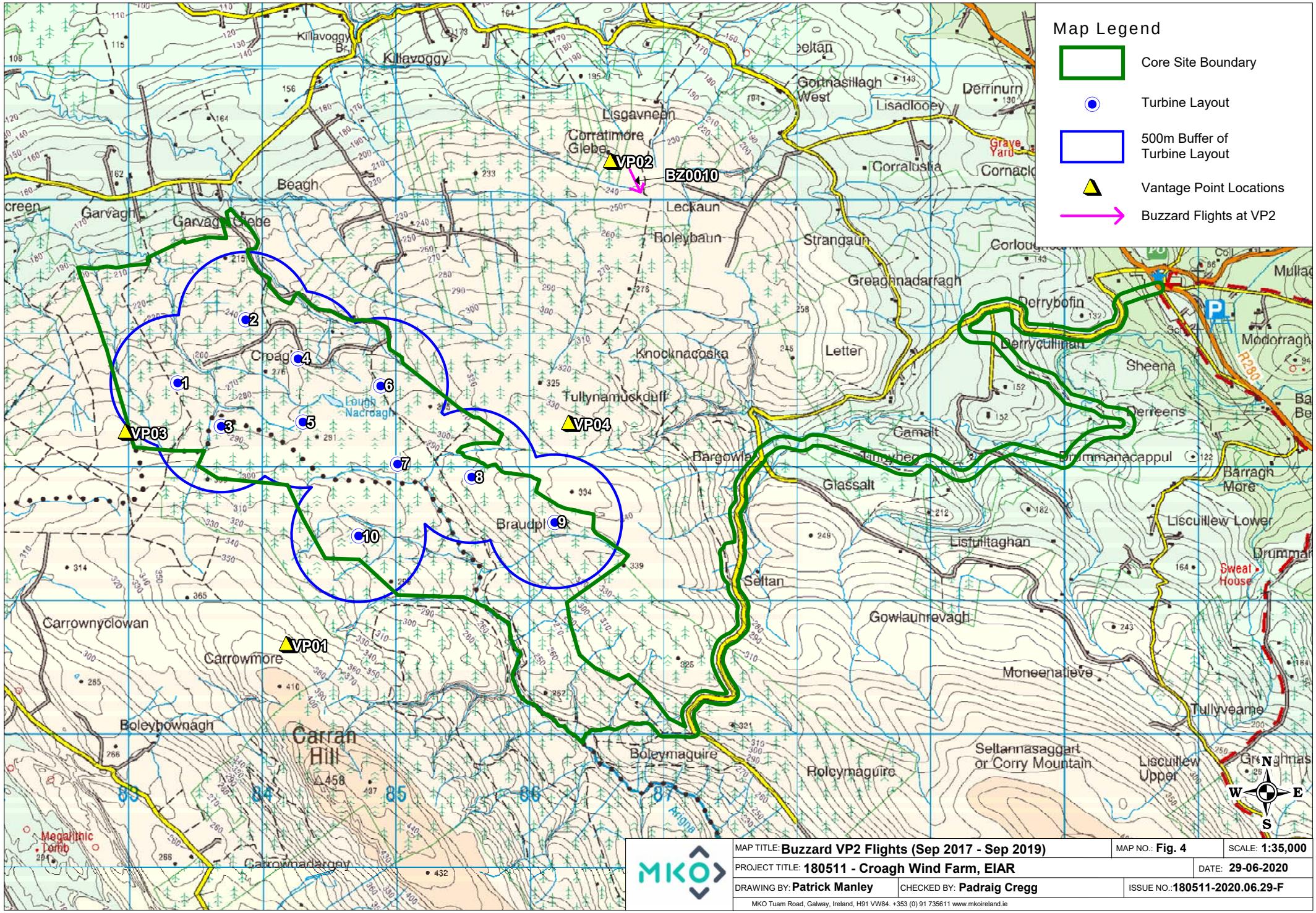
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Table 1-4 Red Grouse VP2 Survey Data (Boleybaun)

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Notes on habitat and activity	Comments	Surveyor
N/A	17/05/2019	2	Red Grouse	1	04:48:00	HH4, (Montane heath) Calling male not seen		AOD

Table 1-5 Buzzard VP2 Survey Data (Boleybaun)

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
BZ0010	12/06/2019	2	Buzzard	2	19:51:00	60		60			60		WD4, (Conifer plantation) Gliding over WD4 before disappearing behind treeline.		PW



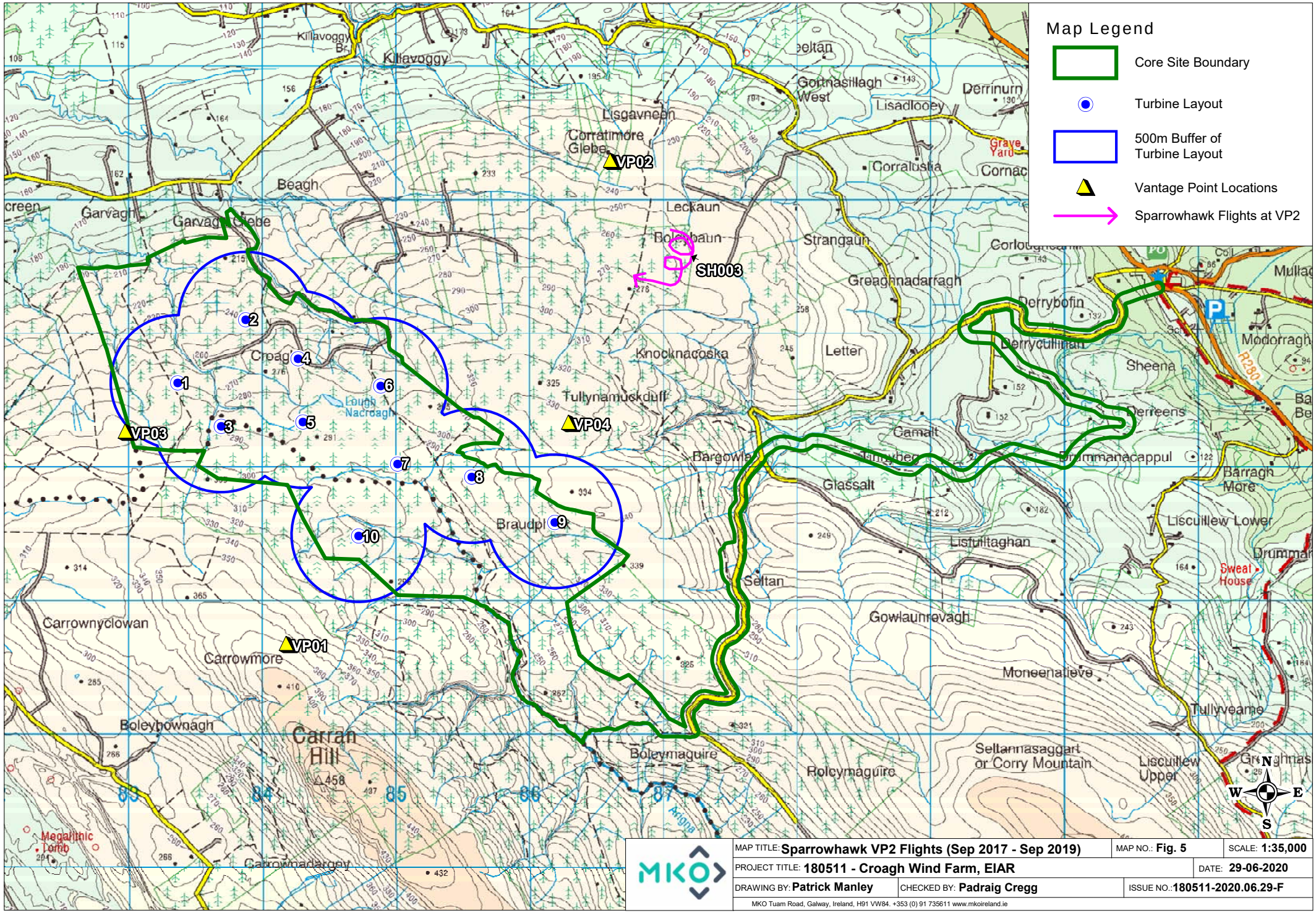
MAP TITLE: **Buzzard VP2 Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 4**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
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Table 1-6 Sparrowhawk VP2 Survey Data (Boleybaun)

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
SH003	12/06/2019	2	Sparrowhawk	1	16:24:00	56	56			56			HH1, (Dry siliceous heath) WD4, (Conifer plantation) Soaring in thermal		PW



MAP TITLE: **Sparrowhawk VP2 Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 5**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
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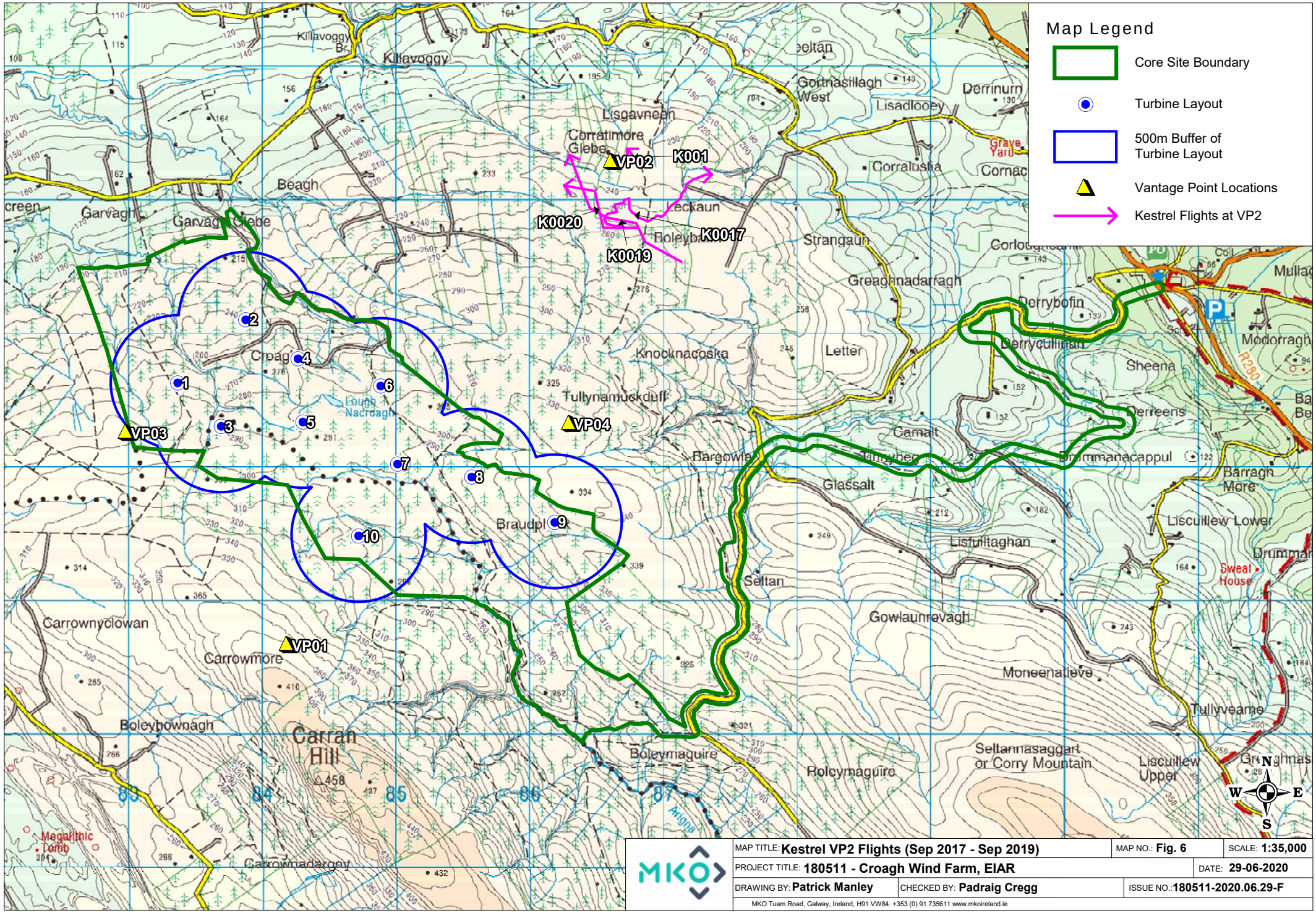
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Table 1-7 Kestrel VP2 Survey Data (Boleybaun)

Map Ref. No.	Date	VP	Species	No. of Birds	Time of flight	Duration of flight (s)	Duration Within 500m Buffer of Site Boundary	Duration Outside	Band 1 (0-10m)	Band 2 (10-25m)	Band 3 PCH (25-175m)	Band 4 (>175m)	Notes on habitat and activity	Comments	Surveyor
K001	05/04/2018	2	Kestrel	1	10:45:00	50				50			PB2, (Upland blanket bog) WD4, (Conifer plantation)		SF
K0017	12/06/2019	2	Kestrel	1	16:58:00	471	460	11	25	221	225		HH1, (Dry siliceous heath) WD4, (Conifer plantation) Male K hunting/hovering over edge of forest and moorland came down to ground three times (marked as dot on map) before rising again and flying northeast.		PW
K0019	03/09/2019	2	Kestrel	1	11:43:00	360	0	360		340	0		HH1, (Dry siliceous heath) WD4, (Conifer plantation)	Adult female foraging flew north	AOD

Table 1-8 Kestrel Winter Transect Survey Observation from Boleybaun Area

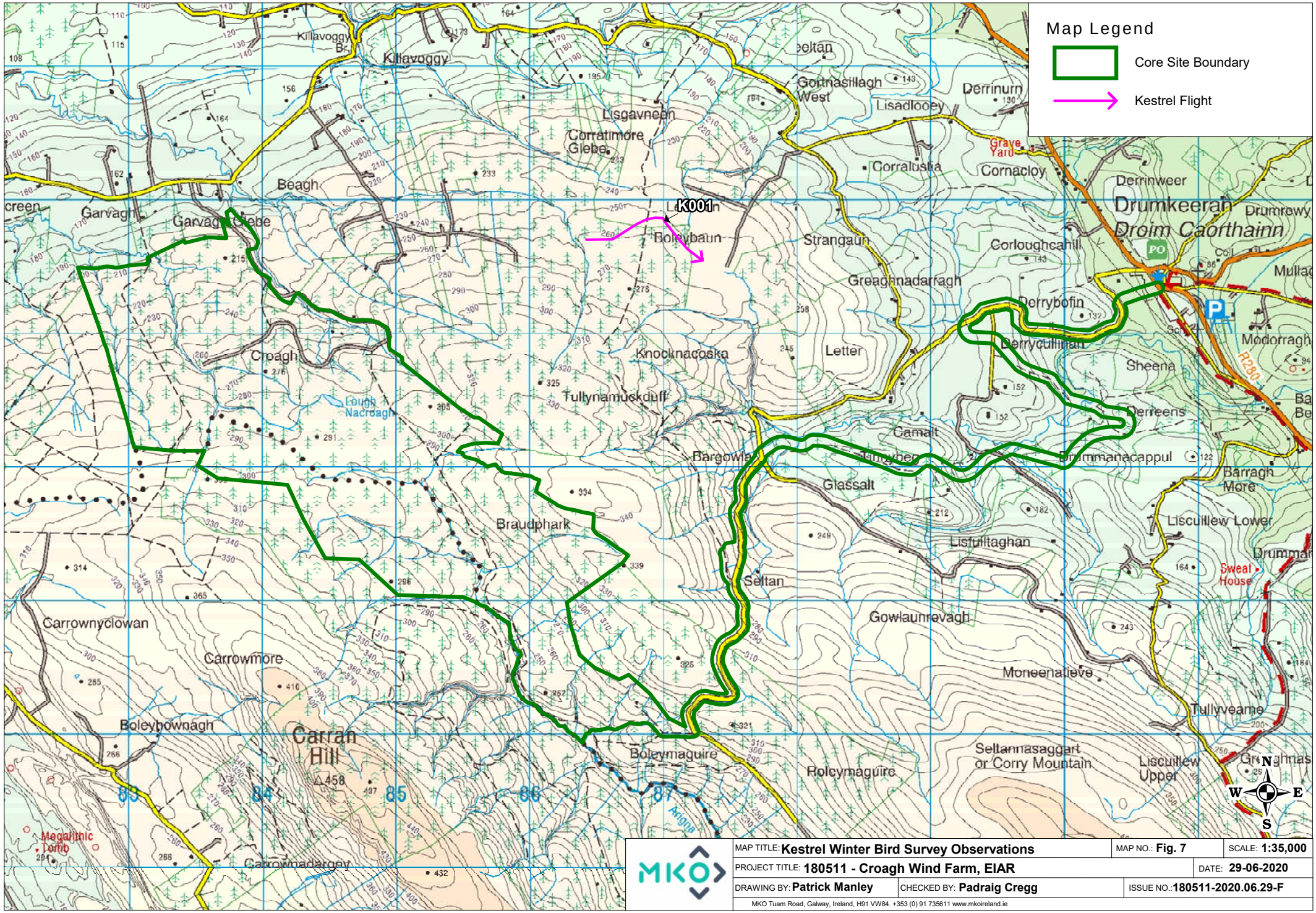
Ref No.	Date	Transect/ Survey Area	Species	No. of Birds	Sex/Age	Time of observation	Habitat and Activity	Comments	Surveyor
K001	17/10/2018		Kestrel	1	ADULT FEMALE	16:30:00	PB2, (Upland blanket bog) WD4, (Conifer plantation)	HUNTING 30S BAND2, HOVERING	AOD



MAP TITLE: **Kestrel VP2 Flights (Sep 2017 - Sep 2019)**		MAP NO.: **Fig. 6**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
DRAWING BY: **Patrick Manley**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.29-F**	

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

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MAP TITLE: **Kestrel Winter Bird Survey Observations**		MAP NO.: **Fig. 7**	SCALE: **1:35,000**
PROJECT TITLE: **180511 - Croagh Wind Farm, EIAR**			DATE: **29-06-2020**
DRAWING BY: **Patrick Manley**	CHECKED BY: **Padraig Cregg**	ISSUE NO.: **180511-2020.06.29-F**	

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Appendix 7-6 – Collision Risk Assessment

Croagh Wind Farm -

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Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

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Table of Contents

1. INTRODUCTION 1
2. METHODOLOGY 2
3. RESULTS 5
BIBLIOGRAPHY 8

TABLE OF TABLES

Table 1 Windfarm Parameters at Croagh Wind Farm 4
Table 2 Croagh Windfarm VP Survey Effort and Viewshed Coverage 5
Table 3 Bird Biometrics (Taken from BTO BirdFacts & Alerstam et al. (2007)) and duration at PCH during VP Surveys 5
Table 4 Random CRM - Number of Transits per Turbine within the Viewshed of each VP 5
Table 5 Number of Transits across site per year (Averages calculated from Table 3.3 Above and adjusted for all ten turbines) 6
Table 6 Collision Risk Workings (Both Flapping and Gliding Flights took the average Collision Risk Percentage between upwind and downwind) 6
*Table 7 Collision Probability assuming no Avoidance (Transits*Collision Risk)* 7
Table 8 Collision Probability using Avoidance Rates outlined in SNH (September 2018 V2) 7
Table 9 Standard Measurements (Specific to Golden Plover, Windfarm Site, Turbines modelled & VP1) 10
Table 10 CRM Stage 1 Calculations using Standard Measurements in Table 1 10
Table 11 CRM Stage 1 Calculations – Number of transits through windfarm 11

1. INTRODUCTION

This document has been prepared by MKO to assess the collision risk for birds at the proposed Croagh Wind Farm Site, Co. Leitrim/Sligo. The collision risk assessment, prepared by Mr David Naughton (BSc), is based on vantage point watch surveys undertaken at the development site from September 2017 up to and including September 2019 covering a full two-year survey period, consisting of two breeding seasons and two non-breeding seasons, in full compliance with SNH (2017). Surveys were undertaken from three fixed Vantage Point (VP) Locations, (i.e. VP1, VP3 & VP4).

Collision risk is calculated using a mathematical model to predict the numbers of individual birds, of a particular species, that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation follows Scottish Natural Heritage (SNH) guidance which is sometimes referred to as the Band Model (Band et al. (2007)).

Two stages are involved in the model:

- Stage 1: Estimation of the number of birds or flights passing through the air space swept by the rotor blades of the wind turbines. Transits are calculated using either the "**Regular** or **Random Flight**" model, depending on flight distribution and behaviour.
- Stage 2: Calculation of the probability of a bird strike occurring. Calculated using a statistical spreadsheet which considers avian biometrics and turbine parameters. This spreadsheet is publicly available on the SNH website. https://www.nature.scot/wind-farm-impacts-birds-calculating-probability-collision

The product of Stage 1 and Stage 2 gives a theoretical annual collision mortality rate on the assumption that birds make no attempt to avoid colliding with turbines.

The Band model has been the subject of academic assessment (e.g. Chamberlain et al., (2005 & 2006), Madders & Whitfield (2006), Drewitt & Langston (2006), Fernley, Lowther & Whitfield (2006)) and its results must be interpreted with a degree of caution.

An informal third stage is then applied to the generated outcome of Stage 1 and Stage 2. This third stage is to account for a "real life" scenario, i.e. to account for the avoidance measures taken by each bird species, worked out as percentage applied to the product of stage 1 and 2. This third "informal" stage is often the most important factor of collision risk modelling. For several years, SNH advocated a highly precautionary approach, recommending a value of 95% as an avoidance rate (Band et al., (2007)). However, based on empirical evidence and continuous studies and literature, precautionary rates have now been increased to 98-99% or higher in most cases and are regularly evolving with further examination of bird behaviour and mortality rates at windfarm sites. The most recently recommended species' avoidance rates can be found at https://www.nature.scot/wind-farm-impacts-birds-guidance-avoidance-rates-guidance.

2. METHODOLOGY

Two forms of collision risk modelling are considered when referencing the Band Model. These are often referred to as the **"Regular Flight Model"** and the **"Random Flight Model"**. The "Regular Flight Model" is generally applied to a suite of flightlines which form a regular pattern such as a commuting corridor between roosting and feeding grounds or migratory routes. As such the "Regular Flight Model" is typically relevant for waterbird species, particularly geese and swans. The "Random Flight Model" is relevant for scenarios whereby no discernible patterns or flight routes can be associated with a species within the study area. Random flights can occur for any species but is most prevalent when examining foraging or hunting flight behaviour.

- **"Random Flight Model"** examines the predicted number of transits through the windfarm by regarding all flights within the viewshed (i.e. a 2km of the vantage point) as randomly occurring. This model therefore assumes that any observed flight could just as easily occur within the windfarm site as without. Any flights recorded as flying within the rotor swept height inside the 2km arc of the vantage point is to be included in the model.
  This model has a number of key assumptions and limitations;

  1. *Bird activity is not spatially explicit, i.e. activity is equal throughout the viewshed area and this is equal to activity in the windfarm area.*
  2. *Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.*
  3. *The area of the view shed used in the analysis is a worst-case scenario, given it is calculated based on the lowest swept height.*
  4. *All flight activity recorded at potential collision risk height within the view shed of relevant VPs are used in the model.*

- **"Regular Flight Model"** examines the predicted number of transits through a cross-sectional area of the windfarm which represents the width of the commuting corridor. A 2-dimesional line represents a "risk window" which is the width of the windfarm plus a 500m buffer of the turbines, multiplied by the rotor diameter. All commuting flights which pass through this risk window, within the swept height of the turbines, are included in collision risk modelling. Any regular flights more than 500m from the turbine layout can be excluded from analysis.
  This model has a number of key assumptions and limitations;

  1. *Firstly, that the turbine rotor swept area is 2-dimensional, i.e. there is a single row of turbines in the windfarm. This represents all turbines within the commuting corridor accounted for by a single straight-line.*
  2. *It is assumed that bird activity is spatially explicit.*
  3. *Birds in an observed flight only cross the turbine area once and do not pass through the cross-section a second time (or multiple times).*

More detail on both the Random and Regular Flight Model calculations are publicly available and can be found on the SNH website. https://www.nature.scot/wind-farm-impacts-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action.

In the case of all species observed at Croagh, flights during the survey period could be classified as randomly distributed flights which could occur anywhere within the given viewsheds. Therefore the "Random Flight Model" was applied to these species to calculate the predicted number of transits through the windfarm site.

The steps used to derive the collision risk percentage for each species observed at the proposed development according to the Band Model are outlined below:

1. Stage 1 (Band): the model uses observations of birds flying through the study area during vantage point surveys to calculate the number of birds estimated to fly through the proposed turbines blade swept areas.

2. Stage 2 (Band): the model calculates the collision risk for an individual bird flying through a rotating turbine blade. The collision risk depends on the species biometrics and flight behaviour. Bird biometrics are available from the British Trust of Ornithology (BTO) online bird collision risk guidance, while flight speeds have been referenced from Alerstam et al. (2007).

3. The product of the number of birds calculated to fly through the turbines in a year multiplied by the collision risk (i.e. that a bird doing so will collide with the moving blades) gives the worst-case scenario for collision mortality. The worst-case scenario assumes that birds flying towards the turbines make no attempt to avoid them.

4. An avoidance factor is applied to the results to account for avoidance of the turbines by birds in flight. This corrects for the ability of the birds to detect and manoeuvre around the turbines. Avoidance rates are available from SNH online bird collision risk guidance (SNH 2018).

5. This final output after all steps to the model is a real-world estimation of the number of collisions that may occur at the wind farm based on observed bird activity during the survey period.

The Band Method makes a number of assumptions on the biometrics of birds and the turbine design. These are:

- Birds are assumed to be of a simple cruciform shape.
- Turbine blades are assumed to have length, depth and pitch angle, but no thickness.
- Birds fly through turbines in straight lines.
- Bird flight is not affected by the slipstream of the turbine blade.
- Because the model assumes that no action is taken by a bird to avoid collision, it is recognised that the collision risk figures derived are purely theoretical and represent worst case estimates.

Several assumptions were made in the calculation of collision risk for the proposed Croagh Windfarm. These assumptions are tailored specifically to Croagh and are as follows:

- Birds in flight within the study area at heights between 25m and 175m are assumed to be in danger of collision with the rotating turbine blades.
- Avoidance factors of individual species are those currently recommended by SNH (2018). An avoidance factor is applied to the results to account for avoidance of the turbines by birds in flight. This corrects for the ability of the birds to detect and manoeuvre around the turbines.
- No preference was taken for birds using flapping or gliding flight through the study area for species which exhibit both behaviours. In the calculation of the percentage risk of collision for a bird flying through a rotating turbine, the mean of the worst-case scenario (i.e. a bird flying upwind through a turbine using flapping flight whilst the turbine is at its fastest rotation speed) and the best-case scenario (i.e. a bird flying downwind through a rotating turbine using a gliding flight whilst the turbine at its slowest rotation speed) has been used for species which exhibit both flapping and gliding flight. Due to the nature of their flight activity, for species such as Swans and Geese only the mean calculations for flapping flights were used.

The Collision Risk Assessment (CRA) also makes assumptions on the turbine specifications, such as rotor diameter and rotational speed. Because the final choice of turbine will not be known until a

competitive tendering process is complete, the worst-case scenario is assumed. The worst-case scenario is a combination of the maximum collision risk area (i.e. swept area determined by hub height and rotor blade length), maximum number of turbines proposed and turbine operational time. The turbine and wind farm characteristics for the purposes of this assessment at the proposed Croagh Windfarm Site are presented in Table 1.

Table 1 Windfarm Parameters at Croagh Wind Farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	GE 3.6-137 Turbine
Number of turbines	10
Blades per turbine rotor (3d model used)	3
Rotor diameter (m)	140
Rotor radius (m)	70
Hub height (m)	100
Swept height (m)	30 - 170
*Mean pitch of blade (degrees)	25
Maximum chord (m) (i.e. depth of blade)	4.0
Max Tip Speed (M/S)	82
Circumference of Blade Tip (Pi*Rotor Diameter)	430.4
Rotational period (s) [430.4/82]	5.25
**Turbine operational time (%)	85%

****This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

*Pitch of Blade used in the Analysis

It is acknowledged that pitch angle is determined by wind speeds which is something that is variable across seasons, and a range of geographical areas. The mean pitch of turbine blades has two referenced figures in Table 2.1 above. Wind speed versus the desired turbine rpm determines blade pitch. There is a specific pitch angle for any given wind speed to optimise output power. Typically speaking, the higher the wind speeds are, the higher the angle of the pitch.

This figure of 25 degrees is from Band (2012) where it is quoted that a standard figure for pitch for most large modern turbines would be between 25 – 30 degrees. This figure is considered highly precautionary however as the paper examines collision risk modelling for offshore windfarms, where windspeeds would be expected to be much higher than an on-shore windfarm site in Sligo/Leitrim.

3. RESULTS

Collison estimates were calculated using flight data recorded during vantage point watches at three vantage point locations (VP1, VP3 and VP4) within the study area between September 2017 and September 2019. The target species recorded within the potential collision risk zone included whooper swan, golden plover, hen harrier, merlin, buzzard, sparrowhawk, kestrel and snipe. It is acknowledged that the predicted number of transits, and hence predicted rate of collision for snipe may be largely underestimated, as flight activity for this species is largely crepuscular in nature while the VP survey sample consists of hours during daylight period for the most (Table 1.4, SNH (2017)).

The calculation parameters are outlined in Tables 2 – 8. A fully worked example of the calculation of collision risk for golden plover is available in Appendix 1.

Table 2 Croagh Windfarm VP Survey Effort and Viewshed Coverage

Vantage Point	Visible Area (hectares)	Risk Area (hectares)	Turbines visible from VP	Total Survey Effort (hrs)
VP1	522.9	275.2	5	153
VP3	545.4	271.5	6	153
VP4	402.1	247.9	6	153

Table 3 Bird Biometrics (Taken from BTO BirdFacts & Alerstam et al. (2007)) and duration at PCH during VP Surveys

Species	Length (m)	Wingspan (m)	Ave. speed (m/s)	Seconds in flight at PCH (25 - 175m)
Whooper Swan (Winter)	1.52	2.30	17.3	6,168
Golden Plover (Winter)	0.28	0.72	17.9	288,352
Hen Harrier	0.48	1.10	9.1	65
Merlin	0.28	0.56	10.1	15
Buzzard	0.54	1.20	13.3	1,401
Sparrowhawk	0.33	0.62	10.0	110
Kestrel	0.34	0.76	10.1	708
Snipe	0.26	0.46	17.1	1,173

Seconds in flight at PCH is calculated by multiplying the number of birds observed per flight by the duration of the flight spent within the height band 10-175m.

Table 4 Random CRM - Number of Transits per Turbine within the Viewshed of each VP

Species	VP1	VP3	VP4
Whooper Swan (Winter)	**130.62**	0	**11.88**
Golden Plover (Winter)	**4,560.17**	**2,136.43**	0
Hen Harrier	**0.46**	**0.28**	0

Species	VP1	VP3	VP4
Merlin	0	**0.18**	0
Buzzard	**7.54**	**8.99**	**8.81**
Sparrowhawk	0	0	**1.82**
Kestrel	0	**7.44**	**1.74**
Snipe	**25.29**	**4.70**	0

Table 5 Number of Transits across site per year (Averages calculated from Table 3.3 Above and adjusted for all ten turbines)

Species	Average Transits	Transits Across Entire Site (All 10 Turbines) (Average Transits*10)
Whooper Swan (Winter)	47.5	475.0
Golden Plover (Winter)	2,232.2	22,322.0
Hen Harrier	0.25	2.5
Merlin	0.06	0.6
Buzzard	8.5	84.5
Sparrowhawk	0.6	6.1
Kestrel	3.1	30.6
Snipe	10.0	100.0

Table 6 Collision Risk Workings (Both Flapping and Gliding Flights took the average Collision Risk Percentage between upwind and downwind)

Species	Flapping Flight	Gliding Flight	Collision Risk [(Flapping + Gliding)/2]
Whooper Swan	9.3%	N/A	**9.3%**
Golden Plover	4.9%	N/A	**4.9%**
Hen Harrier	9.4%	9.3%	**9.35%**
Merlin	7.4%	7.3%	**7.33%**
Buzzard	7.2%	7.0%	**7.1%**
Sparrowhawk	7.7%	7.7%	**7.7%**
Kestrel	7.7%	7.7%	**7.7%**
Snipe	4.9%	N/A	**4.9%**

*Table 7 Collision Probability assuming no Avoidance (Transits*Collision Risk)*

Species	Collision Risk	Transits Across Entire Site	Collisions/year (No Avoidance)
Whooper Swan	9.3%	475.0	**44.06**
Golden Plover	4.9%	22,322.0	**1,101.58**
Hen Harrier	9.35%	2.5	**0.23**
Merlin	7.33%	0.6	**0.05**
Buzzard	7.1%	84.5	**5.96**
Sparrowhawk	7.7%	6.1	**0.47**
Kestrel	7.7%	30.6	**2.36**
Snipe	4.9%	100.0	**4.86**

Table 8 Collision Probability using Avoidance Rates outlined in SNH (September 2018 V2)

Species	Collisions /year	Collisions /30 Years	Avoidance factor (%)	Note
*Whooper Swan	0.220	6.6	99.5%	Winter/Passage (Oct-Mar)
*Golden Plover	22.03	660.9	98%	Winter/Passage (Oct-Mar)
Hen Harrier	0.002	0.07	99%	All year
Merlin	0.0009	0.03	98%	All year
Buzzard	0.119	3.58	98%	All year
Sparrowhawk	0.009	0.28	98%	All year
Kestrel	0.118	3.53	95%	All year
*Snipe	0.097	2.92	98%	All year

***Assumed to be active 25% of the night as well as daylight hours per SNH guidance accounting for Swan/Geese and Wader activity. This is calculated as a portion of the length of night for the survey period provided by www.timeanddate.com and is added to available hours for activity of the species per year.**

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https://www.timeanddate.com/sun/

APPENDIX 1

WORKED EXAMPLE OF COLLISION RISK CALCULATION (RANDOM FLIGHT MODEL) – GOLDEN PLOVER

Stage 1 (Transits through rotors per year) [Using figures from VP1 Column]

Table 9 Standard Measurements (Specific to Golden Plover, Windfarm Site, Turbines modelled & VP1)

Description	Value	Units
Survey area visible from VP (Hectares) [At 30m]	Avp	522.9
Survey Time at VP1 over both winter periods (secs)	s	290,412
Bird observation time at 25-175m (secs)	PCH	194,626
Rotor Radius (metres)	r	70
Rotor Diameter (metres)	D	140
Max chord width of turbine blade (metres)	d	4.0
No. of turbines in viewshed of VP1	x	5
Bird length in metres (golden plover) [Taken from BTO online)	l	0.28
Ave. Flight speed of golden plover (m/s) [Allerstam et al. 2007]	v	17.9
500m buffer of turbines within viewshed, i.e. Area of Risk (Hectares)	Arisk	275.2
Availability of species activity during survey period (hours) [Daylight hours + 25% of night during survey period]	Ba	5,907.73

Table 10 CRM Stage 1 Calculations using Standard Measurements in Table 1

Description	Value	Formula	Units
Proportion of time between 25-175m	t1	s/PCH	0.670172031
Flight activity per visible unit of area	F	t1/Avp	1.28E-03
Proportion of time in risk area	Trisk	F*Arisk	0.3527086
Bird occupancy of risk area	n	Trisk*Ba	2083.70736
Risk volume (Area of risk*Rotor Diameter)	Vw	(Arisk*D)*10,000	385280000
Actual volume of air swept by rotors	o	X*(Pi*r2(d+l))	329427.4057
Bird occupancy of rotor swept area (seconds)	b	3600*(n*(o/Vw))	6413.904471
Time taken for bird to pass through rotors (seconds)	t2	(d+Bl)/v	0.239106145
Number of bird passes through the rotor in the survey period	N	b/t2	26824.50702

Description	Value	Formula	Units
Total transits adjusted for max annual Turbine Operation Time (85% in this case)	Tn	N*0.85	22800.83
Number of transits per turbine within viewshed of VP1	**TnT1**	**Tn/x**	**4560.17**

Table 11 CRM Stage 1 Calculations – Number of transits through windfarm

Description	Value	Formula	Units
Number of transits per turbine with viewshed of VP1	**TnT1**	**Tn/x**	**4560.17**
Number of transits per turbine with viewshed of VP3	TnT2	Tn/x	2136.43
Number of transits per turbine with viewshed of VP4	TnT3	Tn/x	0
Average transits per turbine for all VPs	ATnT	(TnT1+TnT2+TnT3) /3	2232.20
Predicted number of transits through windfarm site (All ten turbines)	T	ATnT*10	22321.98182

Transits through rotors for the species in a one-year period across the site

22,322

Stage 2 (Collision Probability)

Calculation of the probability of the birds colliding with the turbine rotors:

The probability of a bird colliding with the turbine blades when making a transit through a rotor depends on a number of estimated factors. These factors include the avoidance factor 98% – the ability of birds to take evasive action when coming close to wind turbine blades.

In the calculations, the length of a golden plover was taken to be 0.28 metres and the wingspan 0.72 metres. The flight velocity of the bird is assumed to be 17.9 metres per second. The maximum chord of the blades is taken to be 4.0 metres, variable pitch is assumed to be 25 degrees and the average rotation cycle is taken to be 5.25 seconds per rotation, depending on wind conditions.

A probability, ρ (r, ϕ), of collision for a bird at radius r from the hub and at a position along a radial line that is at angle ϕ from the vertical is calculated. This probability is then integrated over the entire rotor disc, assuming that the bird transit may be anywhere at random within the area of the disc. Scottish Natural Heritage (SNH) have made available a spreadsheet to aid the calculation of these probabilities. For a full explanation of the calculation methods see Band et al. (2007). The results of these calculations for all species are shown in Table 3-7.

Collision Probability*

4.9%

*This is calculated using the SNH collision risk probability model at https://www.nature.scot/wind-farm-impacts-birds-calculating-probability-collision

Collisions per year

The annual theoretical collision rate assuming no avoidance = Transits (T)*Collision probability

1,101.6

The annual theoretical collision rate assuming 98% avoidance (1,101.6*0.02)

22.03

Theoretical collision rate assuming 98% avoidance across the 30-year duration of the windfarm (22.03*30)

660.9

Appendix 7-7 – Bird Monitoring Programme

Croagh Wind Farm

DOCUMENT DETAILS

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Table of Contents

1. INTRODUCTION 1
1.1 Key Ornithological Receptors and Birds of Conservation Concern 1
1.3 Objectives 2
2.1 Methodology 3
2.2 Pre-construction Bird Monitoring 3
2.3 Post-construction Bird Monitoring 3
2.3 Collision Searches (Bird Casualties) 5
3. TIMEFRAME OF PROPOSED MONITORING WORKS 6
4. REPORTING 7
BIBLIOGRAPHY 8

TABLE OF TABLES

Table 1 Key Ornithological Receptors identified during field surveys undertaken at the Croagh Community Wind Farm 1
Table 2 Proposed bird monitoring work schedule for each monitoring year at the Croagh Wind Farm 6

1. INTRODUCTION

This Bird Monitoring Programme has been prepared by MKO for the proposed Croagh Wind Farm, Co. Leitrim/Sligo.

This document provides a timeframe and monitoring schedule for the bird population of the study area during the post-construction phase of the project. Breeding and wintering bird surveys were undertaken during the period September 2017 to September 2019 encompassing two full breeding seasons and two full winter seasons, as well as autumn and spring migration periods, in line with SNH guidance on recommended bird survey methods to inform impact assessment for onshore wind energy developments (SNH, 2017). The surveys undertaken to date have informed the various proposed bird monitoring measures outlined in this document.

1.1 Key Ornithological Receptors and Birds of Conservation Concern

Table 1 lists the Key Ornithological Receptors recorded within the study area during field surveys.

Table 1 Key Ornithological Receptors identified during field surveys undertaken at the Croagh Community Wind Farm

Common Name	Latin Name	Conservation Status
Whooper Swan	*Cygnus cygnus*	Annex I; EU Birds Directive,
Golden Plover	*Pluvialis apricaria*	Annex I; EU Birds Directive, BoCCI Red List & Irish Wildlife Act
Hen Harrier	*Circus cyaneus*	Annex I; EU Birds Directive; BoCCI Amber List & Irish Wildlife Act.
Merlin	*Falco columbarius*	Annex I; EU Birds Directive; BoCCI Amber List & Irish Wildlife Act.
Red Grouse	*Lagopus lagopus*	BOCCI Red Listed with regard to Breeding Populations
Woodcock	*Scolopax rusticola*	BOCCI Red Listed with regard to Breeding Populations
Buzzard	*Buteo buteo*	Raptor Species; Schedule 4 of the Wildlife Act 1976
Sparrowhawk	*Accipiter nisus*	Raptor Species; Schedule 4 of the Wildlife Act 1976
Kestrel	*Falco tinnunculus*	Raptor Species; Schedule 4 of the Wildlife Act 1976
Snipe	*Gallinago gallinago*	BoCCI Amber Listed, Bio-indicator Species for Hen Harrier

1.3 Objectives

This document has been prepared having regard to the following objectives:

- To ensure any required pre-commencement/ pre-construction phase monitoring is scheduled to ensure any impacts on breeding birds are avoided.
- To record usage of the site by birds and interaction with operating turbines during the post-construction phase of the development.
- To monitor short-term and long-term effects on bird populations with a particular emphasis on wintering and breeding birds deemed to be of high conservation concern (Annex I; EU Birds Directive and BoCCI red list species).
- To undertake collision monitoring and corpse searches for potential bird fatalities as a result of collision with turbine blades.
- Report on findings of post construction monitoring at the end of each monitoring year (Year 1, 2, 3, 5, 10 & 15 of the life time of the wind farm).

2.1 Methodology

2.2 Pre-construction Bird Monitoring

It is proposed that construction works will commence outside the bird nesting season (1st of March to 31st of August inclusive) to avoid the most sensitive time of the year for most bird species with the potential to use the site and its environs. Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm.

A breeding bird survey will be undertaken between April and July. Monitoring will be undertaken by a suitably qualified ornithologist. The survey will include a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows. If breeding activity of birds of high conservation concern is identified, the nest site will be located, and earmarked for monitoring at the beginning of the first breeding season of the construction phase. If it is found to be active during the construction phase no works shall be undertaken within a 500m buffer (Forestry Commission Scotland 2006; Ruddock & Whitfield 2007) in line with best practise. No works shall be permitted within the buffer until it can be demonstrated that the nest is no longer occupied.

All site staff and subcontractors will be made aware of any restrictions to be imposed by means of a toolbox talk and a map of the 'no-work zone' will be made available to all construction staff. The restricted area will also be marked off using hazard-tape fencing to alert all personnel on site to the suspension of works within that area.

2.3 Post-construction Bird Monitoring

Survey methods employed for post-construction monitoring will be in line with guidelines issued by the Scottish Natural Heritage (SNH, 2009). Post-construction monitoring will be undertaken in Years 1, 2, 3, 5, 10 and 15 of the life time of the wind farm.

Post-construction monitoring will include ongoing breeding bird surveys, winter surveys and a programme of regular corpse searching of birds that may potentially collide with operating turbines during the operational phase of the wind farm project.

Bird monitoring will include the following survey methods:

- Vantage Point Surveys
- Distribution & Abundance Surveys (Particular focus on breeding and wintering hen harrier and upland breeding waders)
- Targeted bird collision surveys (corpse searches) will be undertaken. The surveys will include detection and scavenger trials, to correct for these two biases and ensure the resulting data is robust.

Vantage Point Surveys

Vantage point surveys will be undertaken monthly during operational years 1, 2, 3, 5, 10 and 15 of the life time of the wind farm. Methodology for vantage point watches will follow guidelines issued by the SNH (2009) & SNH (2017). The proposed vantage point watches will adhere to a minimum of 36 hours/VP during the breeding survey season as per guidelines issued by SNH. Monthly visits will be undertaken during monitoring years. During each visit, six-hour vantage point watches will be undertaken from a fixed vantage point location that offers an un-interrupted view of the study area. Vantage points will be undertaken from the same locations that pre-planning surveys which informed the EIAR application of the proposed development (i.e. VP1, VP3, VP4). Vantage point surveys will be timed to provide a spread over the full daylight period including dawn and dusk watches to coincide

with the highest periods of bird activity. Behavioural categories for the observation of bird interactions with operational wind farms will be in line with terminology outlined by Meredith et al., (2002).

Distribution & Abundance Surveys

During the breeding season, post-construction distribution & abundance surveys will incorporate a combination of Adapted Brown & Shepherd surveys and transect surveys (Bibby et al., 2000) as well as Breeding Raptor surveys within 2km of the development site with a particular emphasis on breeding hen harrier (Hardey et al., 2013). Survey methodology will be similar to methods employed for baseline EIAR surveys which will allow a comparison of data to be made for each monitoring year.

During Adapted Brown & Shepherd surveys and transect surveys within 500m, particular attention will be paid to upland breeding waders (e.g. curlew) as well as breeding hen harrier, although all bird species and breeding activity will be recorded. The standard approach for surveying upland breeding waders is outlined in Brown and Shepherd (1993) and Gilbert et al. (1998). On site surveys will consist of the surveyors walking a route within quadrats which will have been selected to survey all suitable habitat types on site and to a 500m radius from the development/planning boundary (where access allows). Quadrat coverage should be such that every point of suitable habitat (on site and to a 500m radius) should be surveyed to within 100m. Surveyors should spend 20-25 minutes in each 500 x 500m quadrat (or field). Four visit will be timed to coincide with the core survey period April – July during monitoring years. Notes will be recorded on nesting and territorial behaviour and breeding signs using standard BTO codes. Non-breeding behaviour such as birds flying over the site will also be recorded.

In addition, shortened vantage point watches will be undertaken within 2km of the development site, in areas of suitable breeding habitat, to survey for breeding raptors within the wider area (e.g. hen harrier) in line with Hardey et al., (2013). Aural and visual registrations will be recorded during field surveys.

Hen Harrier Roost Surveys

As recommended by Gilbert et al (1998), hen harrier roost surveys will be undertaken during the winter season (October – March). Survey work will be undertaken in accordance with methods devised by Hardey et al. (2013) and the 'Irish Hen Harrier Winter Roost Survey' (unpublished document coordinated by members of NPWS). Surveys will take place on a monthly basis between October and March. The surveys will focus on area of potential winter roosting habitat within a 2km radius of the proposed development area.

2.3 Collision Searches (Bird Casualties)

Surveys for bird casualties will follow survey methods broadly based on guidelines issued by the Scottish Natural Heritage (2009) and search methods adopted by Duffy & Steward, 'Turbine Search Methods and Carcass Removal Trials at the Braes of Doune Windfarm' (Natural Research Information Note 4. Natural Research Ltd, Banchory, UK, 2008).

It is proposed to undertake a minimum of one visit per month during each survey year. During each visit, searches will be undertaken at each operating turbine location by a team of two surveyors. A plot measuring 130m x 130m from the centre of each turbine location will be the subject of targeted searches for bird casualties. Searches will incorporate the use of transects spaced at 10m intervals apart with the observer covering 5m on either side for each transect. Locations and coordinates of transect routes will be confirmed using a portable GPS recording device. Recording sheets will be used to document bird carcasses encountered in the field.

Alternatively, a trained dog and handler may be used where possible to locate any carcasses.

The following details will be considered during field surveys: GPS location of each bird carcass, photographic record, carcass condition (intact (carcass that is completely intact or not badly composed), scavenged (evidence that the carcass was fed upon by a scavenger/predator) or feather spot (ten or more feathers indicating predation or scavenging or two or more primary feathers must be present to consider the carcass a casualty)), distance from the turbine location, date, time, etc.

Corpse searching work will be calibrated to account for the ability to find bird corpses and likelihood of scavenging of corpses by animals. This will ensure a more accurate estimation of the total number of collision victims. To allow for this, sample bird corpses of various bird sizes will be placed within the various habitats found within proximity of the turbine locations. Carcasses will be left out in the trial areas by one worker and searched for by another two days later. A 36-hour period between laying carcasses and searching for them will help to prevent disturbance from discouraging scavengers from attending the trial plots. The locations of all carcasses will be logged using GPS by the layer and the finder. Any signs of scavenging will be recorded. Birds will be left in place for a further two weeks before a further examination will occur in order to determine further scavenging levels. The level of scavenging which occurs will then be used to help calibrate the detection rate and estimate a likely percentage of collisions that may be removed by scavengers between searches.

Results of bird casualties will be issued in a final report at the end of each monitoring year.

3. TIMEFRAME OF PROPOSED MONITORING WORKS

It is proposed to undertake bird monitoring surveys during years 1, 2, 3, 5, 10 & 15 of the wind farm operation.

Table 2 below describes the proposed bird monitoring work schedule for each monitoring year for the proposed wind farm development

Table 2 Proposed bird monitoring work schedule for each monitoring year at the Croagh Wind Farm

Survey Type	Phase	Period	No. of Visits	Survey Method
Vantage Point Surveys	Year 1, 2, 3, 5, 10 & 15	January - December	3 visits / month	Three fixed, 6-hour, Vantage Point Surveys
Distribution & Abundance Survey (Breeding Season)	Year 1, 2, 3, 5, 10 & 15	April - July	4 visits / monitoring year	Adapted Brown & Shepherd Survey/Walked transect/Raptor VP Survey
Hen Harrier Roost Surveys	Year 1, 2, 3, 5, 10 & 15	October - March	6 visits / month	Hardey et al. (2013) and the 'Irish Hen Harrier Winter Roost Survey' (unpublished document coordinated by members of NPWS)
Corpse Searches (Bird Casualties)	Year 1, 2, 3, 5, 10 & 15	January - December	1 visit/month for each monitoring year	Targeted corpse searches at turbine bases

4. REPORTING

A report summarising the findings of the bird monitoring surveys will be submitted to the Planning Authority, where required, within three months of each monitoring year. This will provide details of the various methods employed, the results of field surveys (vantage point watches, corpse searches, distribution and abundance surveys), potential effects/impacts on birds and any recommendations that may inform additional mitigation measures during the operational phase of the wind farm project.

Maps outlining flight lines of key target species will be produced using GIS software applications to accompany the final report at the end of each monitoring year.

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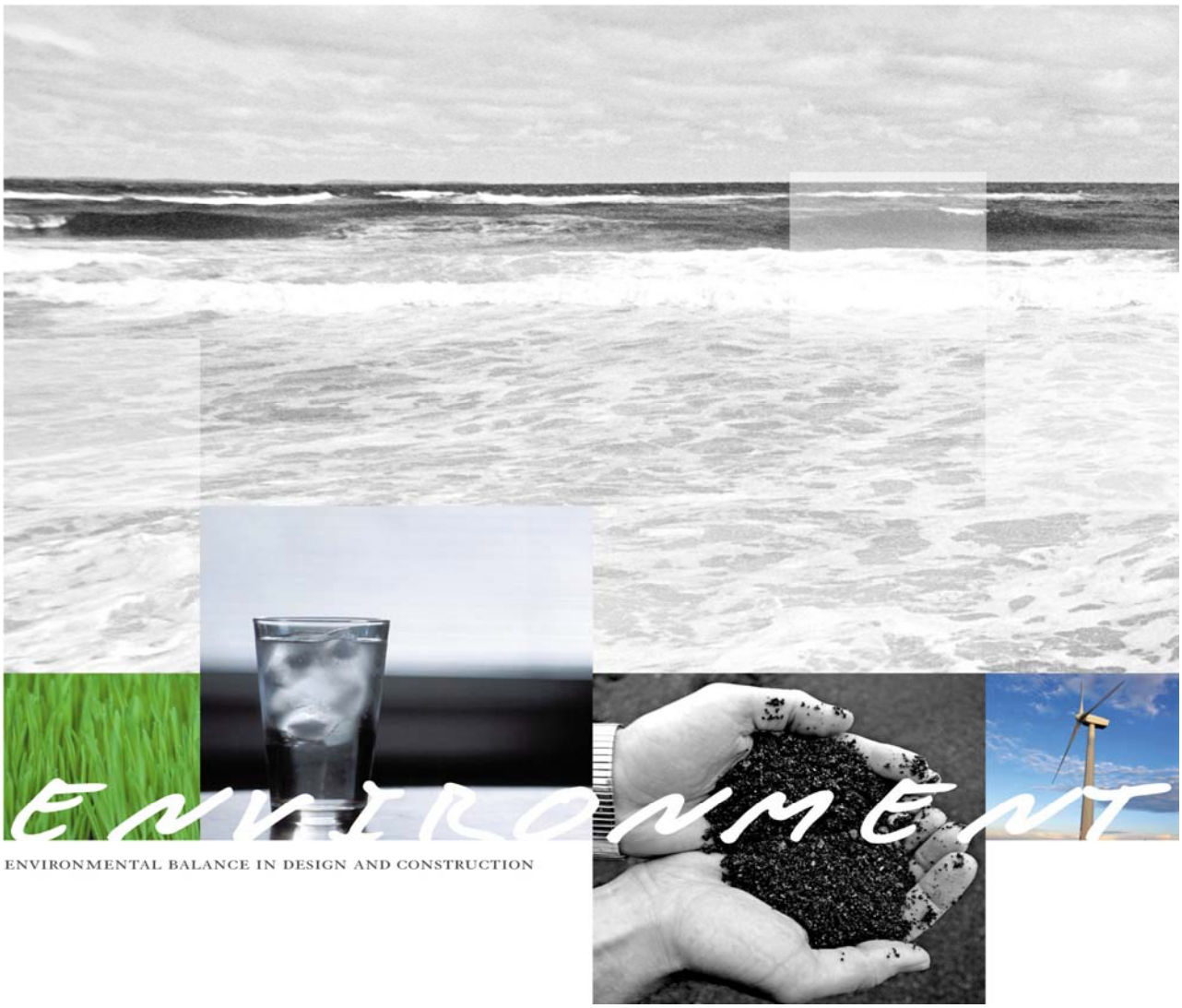
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GEOTECHNICAL & PEAT STABILITY ASSESSMENT REPORT FOR CROAGH WIND FARM, CO. LEITRIM/SLIGO

McCarthy Keville O'Sullivan

JUNE 2020

MKO

FEHILY TIMONEY
30 YEARS

Geotechnical & Peat Stability Assessment Report for Croagh Wind Farm, Co. Leitrim/Sligo

McCarthy Keville O'Sullivan

User is Responsible for Checking the Revision Status of This Document

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1	Reissued to include delivery route and change to met mast location.	IH	PJ	BdH	19 Mar 20
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Client: McCarthy Keville O'Sullivan

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Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan to undertake a geotechnical assessment of the proposed Croagh wind farm site with respect to peat stability. As part of the geotechnical assessment of the proposed development, FT completed walkover surveys at the site and a ground investigation comprising 27 no. trial pits and 4 no. boreholes with associated laboratory testing was also carried out. The findings of the geotechnical and peat stability assessment showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development.

TABLE OF CONTENTS

PAGE

1 NON-TECHNICAL SUMMARY 1

2 INTRODUCTION 2

2.1 Background and Experience 2
2.2 Peat Stability Assessment Methodology 2
2.3 Peat Failure Definition 5
2.4 Main Approaches to Assessing Peat Stability 5
2.5 Peat Stability Assessment – Deterministic Approach 5
2.6 Applicability of the Factor of Safety (Deterministic) Approach for Peat Slopes 6
2.7 Assessment of Intense Rainfall and Extreme Dry Events on the Peat Slopes 6

3 DESK STUDY 8

3.1 Desk Study 8
3.2 Review of Previous Failures 8
3.2.1 Historical Landslides on Site 8
3.2.2 2016 Landslide 9
3.3 Review of OSI Mapping 9
3.4 Soils, Subsoil & Bedrock 10
3.5 Ground Conditions along Grid Connection Route 10

4 SITE WALKOVER 11

4.1 Findings of Site Walkover for Wind Farm 11
4.2 Findings of Site Walkover for 2016 Landslide 13
4.3 Findings of Walkover for Upland Slopes (outside of site boundary) 14
4.3.1 Southwestern Upland Slopes 14
4.3.2 Eastern Upland Slopes 14

5 GROUND INVESTIGATION 17

5.1 Summary of In-situ & Laboratory Tests 17
5.2 Interpretation & Summary of Ground Conditions 18
5.3 Overview of Ground Conditions 19
5.4 Summary of Geotechnical Parameters 19

6 PEAT DEPTH, STRENGTH & SLOPE AT PROPOSED INFRASTRUCTURE LOCATIONS .. 22

7 PEAT STABILITY ASSESSMENT 25

7.1 Methodology for Peat Stability Assessment 25
7.2 Analysis to Determine Factor of Safety (Deterministic Approach) 26
7.3 Results of Analysis 28
7.3.1 Undrained Analysis for the Peat 28
7.3.2 Drained Analysis for the Peat 31

8 PEAT STABILITY RISK ASSESSMENT 32

8.1 Summary of Risk Assessment Results 32

9 COMPARISON OF SITE CONDITIONS WITH KNOWN FAILED SITES 34

10 IMPLICATIONS OF SOFT DEPOSIT UNDERLYING PEAT 38

11 INDICATIVE FOUNDATION TYPE FOR TURBINES 39

12 FOUNDING DETAILS FOR OTHER INFRASTRUCTURE ELEMENTS 40

12.1 Access Roads 40
12.2 Crane Hardstands 40
12.3 Substation Foundations & Platforms 40
12.4 Temporary Construction Compound Platforms 40

12.5 Met Mast Foundation 41
12.6 Potential for Development of a Borrow Pit 41
12.7 Peat Repository Areas 41
12.8 Recreational Infrastructure 41

13 SUMMARY AND RECOMMENDATIONS 42

13.1 Summary 42
13.2 Recommendations 43

14 REFERENCES 44

LIST OF APPENDICES

Appendix A: Photos from FT/AGEC Site Walkover
Appendix B: Ground Investigation (2017) – Trial Pit Logs, Laboratory Testing & Photographs
Appendix C: Ground Investigation (2019/20) – Trial Pit Logs, Laboratory Testing & Photographs
Appendix D: Ground Investigation (2019) – Borehole Logs, Laboratory Testing & Photographs
Appendix E: Peat Stability Risk Register
Appendix F: Calculated FOS for Peat Slopes
Appendix G: Methodology for Peat Stability Assessment

LIST OF FIGURES

PAGE

FIGURE 2-1: FLOW DIAGRAM SHOWING GENERAL METHODOLOGY FOR PEAT STABILITY ASSESSMENT 4
FIGURE 2-2: PEAT SLOPE SHOWING BALANCE OF FORCES TO MAINTAIN STABILITY 6
FIGURE 3-1: PLAN SHOWING LANDSLIDE EVENTS AND LANDSLIDE SUSCEPTIBILITY (GSI, 2019).....9
FIGURE 4-1: PEAT DEPTH CONTOUR PLAN 12
FIGURE 4-2: INDICATIVE EXTENT OF ADJACENT UPLAND SLOPES INSPECTED BY FTC 15
FIGURE 4-3: CONSTRUCTION BUFFER ZONE PLAN 16
FIGURE 5-1: GROUND INVESTIGATION LOCATION PLAN.....21
FIGURE 6-1: UNDRAINED SHEAR STRENGTH (C_U) PROFILE FOR PEAT WITH DEPTH 24
FIGURE 7-1: FACTOR OF SAFETY PLAN – SHORT TERM CRITICAL CONDITION (UNDRAINED).....30
FIGURE 9-1: COMPARISON OF PEAT STRENGTH (SHEAR VANE) WITH DEPTH FROM OTHER SITES 36
FIGURE 9-2: COMPARISON OF DISTRIBUTION OF PEAT STRENGTH (SHEAR VANE) FROM OTHER SITES 37

LIST OF TABLES

TABLE 5-1: SUMMARY OF GEOTECHNICAL PARAMETERS 17
TABLE 5-2: SUMMARY OF GEOTECHNICAL PARAMETERS 20
TABLE 6-1: PEAT DEPTH & SLOPE ANGLE AT PROPOSED INFRASTRUCTURE LOCATIONS.....22
TABLE 7-1: LIST OF EFFECTIVE COHESION AND FRICTION ANGLE VALUES.....25
TABLE 7-2: FACTOR OF SAFETY LIMITS FOR SLOPES.....27
TABLE 7-3: FACTOR OF SAFETY RESULTS (UNDRAINED CONDITION) 29
TABLE 7-4: FACTOR OF SAFETY RESULTS (DRAINED CONDITION) 31
TABLE 8-1: RISK RATING LEGEND 32
TABLE 8-2: SUMMARY OF PEAT STABILITY RISK REGISTER 32
TABLE 11-1: SUMMARY OF INDICATIVE TURBINE FOUNDATION TYPE 39

1 NON-TECHNICAL SUMMARY

Fehily Timoney and Company (FT) formerly Applied Ground Engineering Consultants Ltd (AGEC) were engaged by McCarthy Keville O'Sullivan to undertake a geotechnical assessment of the proposed Croagh wind farm site with respect to peat stability. In accordance with planning guidelines compiled by the Department of the Environment, Heritage and Local Government (DoEHLG), where peat is present on a proposed wind farm development, a peat stability assessment is required.

The findings of the peat assessment, which involved analysis of 324 no. locations, showed that the proposed development areas have an acceptable margin of safety and that the site is suitable for the proposed wind farm development. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

The proposed wind farm comprises 10 no. wind turbines with associated infrastructure including access roads (new and upgrading of existing roads), substation, temporary construction compounds, met mast, borrow pit, repository areas and underground cabling and grid connection route.

The site is typically covered in blanket peat with undulating terrain. Up to 11.1km of existing tracks are present on the site and have been in operation for a number of years. Peat depths vary across the site depending on mainly topography. Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m. Peat depths recorded across the site from over 850 no. peat depth probes ranged from 0 to 8.2m with an average of 2.2m. The deeper peat areas were avoided when optimising the wind farm layout and main infrastructure elements for site.

Ground conditions typically comprised peat overlying soft silt/clay overlying glacial till overlying bedrock.

The peat depths recorded at the turbine locations varied from 0.3 to 4.5m with an average depth of 2.0m. The slope angle at the turbine locations range from 2 to 12 degrees, locally up to 12 degrees where the peat depth is shallow.

Numerous walkovers including intrusive peat depth probing and strength testing, a ground investigation including trial pits and boreholes, desk study, stability analysis and risk assessment was carried out to assess the susceptibility of the site to peat failure following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRA, 2017).

The purpose of the stability analysis undertaken was to determine the stability i.e. Factor of Safety (FoS), of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a FoS of greater than 1.0 indicates a stable slope. An acceptable FoS for slopes is generally taken as a minimum of 1.3.

Based on the stability assessment carried out on the peat slopes the calculated FoS's are acceptable. The risk assessment at each of the main infrastructure locations includes mitigation/control measures to ensure the continued stability of the site.

The findings of the peat assessment, which involved analysis of 324 no. locations, showed that the proposed development areas have an acceptable margin of safety and that the site is suitable for the proposed wind farm development. Notwithstanding the above, there is an elevated risk of developing such a site in an area with a high density of historical landslides. The management of peat stability and appropriate construction practices will be inherent in the construction phase of the wind farm to ensure peat failures do not occur on site. Overall, the peat characteristics and ground conditions on the Croagh site are similar to that encountered on successfully developed wind farm sites in the area. In summary, the findings of the geotechnical and peat stability assessment showed that the proposed Croagh wind farm site has an acceptable margin of safety and is suitable for wind farm development.

2 INTRODUCTION

2.1 Background and Experience

Fehily Timoney and Company (FT) formerly Applied Ground Engineering Consultants Ltd (AGEC) were engaged in August 2018 by McCarthy Keville O'Sullivan (MKO) to undertake a geotechnical assessment of the proposed wind farm site with respect to peat stability.

FT/AGEC have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, design, construction and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

The proposed development site is located on the boundary of Counties Leitrim and Sligo, adjacent to the village of Drumkeeran and 7.3km southeast of Dromahair.

The site is within the northwest part of the Lough Allen upland, which typically comprises plateau and ridges with steep sides separated by valleys. The approximate development area for the site is 6.7km^2. A number of existing wind farm developments are located in close proximity to the site.

The proposed wind farm will comprise 10 no. turbines with a tip height of up to 170 metres and all associated foundations and hardstanding areas, access roads including upgrade of existing site roads and provision of new roads, 1 no. onsite electrical substation, excavation of 1 no. borrow pit, underground electrical and communications cabling connecting the turbines to the proposed onsite substation, underground cabling connecting the onsite substation to the existing Garvagh substation, 2 no. temporary construction compounds, 1 no. permanent anemometry mast, recreational car park, trails and signage, site drainage and all associated works.

A number of walkover surveys of the site were carried out by FT/AGEC between 2017 and 2020. The peat depth data previously recorded by FT/AGEC will be used in the assessment of peat stability for the proposed wind farm.

A number of walkover surveys of the site were also carried out by MKO, Hydro Environmental Services (HES) and Coillte between 2017 and 2020. The peat depth data recorded by MKO and HES during these walkover surveys was also used in the assessment of peat stability for the proposed wind farm.

In addition to the above, a ground investigation comprising 44 no. trial pits and 4 no. boreholes with associated laboratory testing was also carried out at the site. A further 6 no. trial pits were excavated along the proposed turbine delivery route in 2020.

2.2 Peat Stability Assessment Methodology

FT undertook the assessment following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (2nd Edition, PLHRA, 2017). The Peat Hazard and Risk Assessment is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

The best practice guide was originally produced following peat failures in the Shetland Islands, Scotland in September 2003 but more pertinently following the peat failure in October 2003, during the construction of a wind farm at Derrybrien, County Galway, Ireland.

The geotechnical assessment of peat stability at the proposed site included the following activities:

(1) Desk study

(2) Site walkover findings including shear strength and peat depth measurements

(3) Interpretation of ground investigation data (trial pits and boreholes)

(4) Overview of ground conditions and summary of ground investigation works carried out at the site

(5) Peat stability assessment of the peat slopes on site using a deterministic and qualitative approach

(6) Peat contour depth plan – based on peat depth probes carried out across the site by FT/AGEC, MKO and HES

(7) Factor of safety plan – is compiled for the short-term critical condition (undrained) for 324 no. FoS points analysed across the site

(8) Construction buffer zone plan – identifies areas with an elevated or higher construction risk where mitigation/control measures will need to be implemented during construction to minimise the potential risks and ensure they are kept within an acceptable range. In addition, the plan identifies areas on site where no development is advised

(9) A peat stability risk register is compiled to assess the potential design/construction risks at the infrastructure locations and determine adequate mitigation/control measures for each location to minimise the potential risks and ensure they are kept within an acceptable range, where necessary

(10) Comparison of site conditions with known failed sites

(11) Summary of the main implications of the soft deposits underlying the peat

(12) Indicative founding depths and details for the turbine foundations and other infrastructure elements

(13) Conclusions & recommendations

A flow diagram showing the general methodology for peat stability assessment is shown in Figure 2-1. The methodology illustrates the optimisation of the wind farm layout based on the findings from a site walkover and subsequent feedback from the peat stability and risk assessment results.

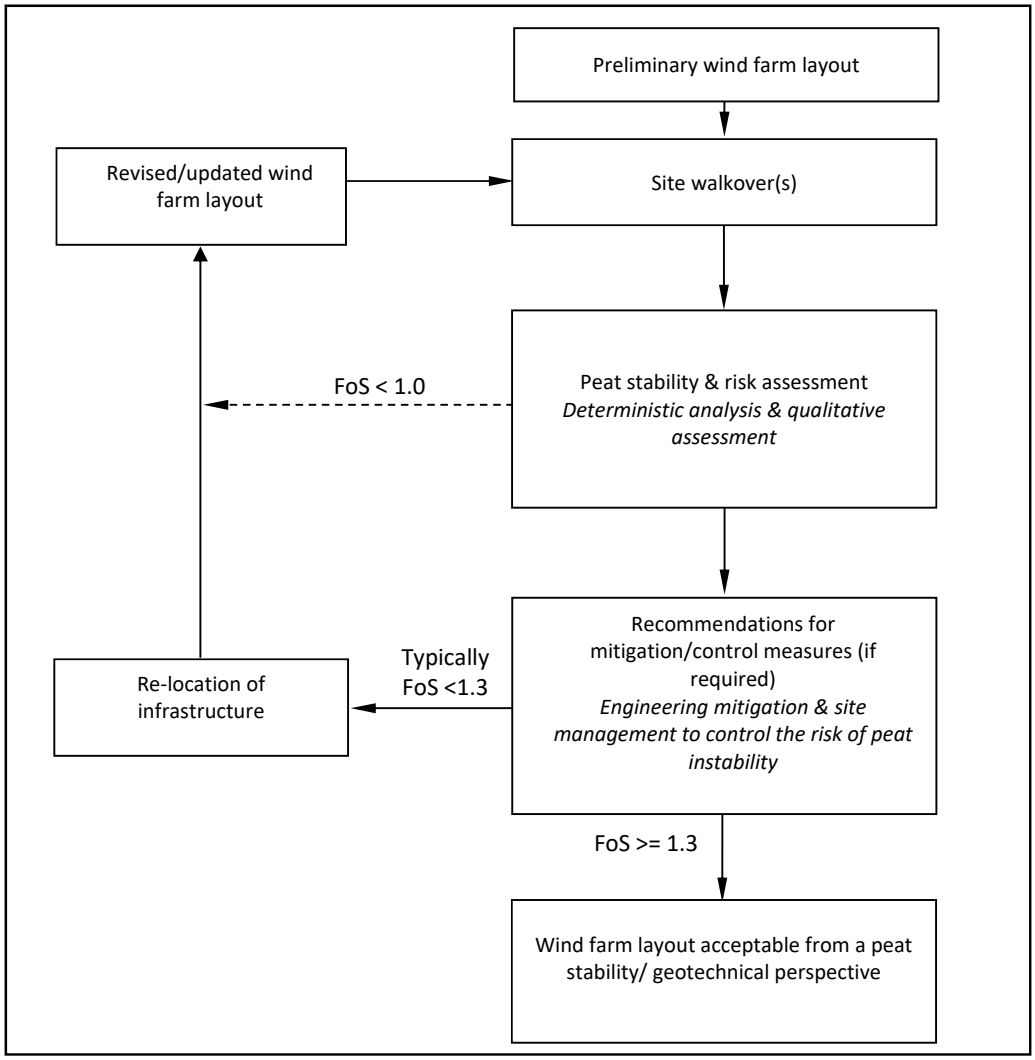


Figure 2-1: Flow Diagram Showing General Methodology for Peat Stability Assessment

2.3 Peat Failure Definition

Peat failure in this report refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that would occur below an access road, creep movement or erosion type events.

The potential for peat failure at this site is examined with respect to wind farm construction and associated activity.

2.4 Main Approaches to Assessing Peat Stability

The main approaches for assessing peat stability for wind farm developments include the following:

(a) Geomorphological

(b) Qualitative (judgement)

(c) Index/Probabilistic (probability)

(d) Deterministic (factor of safety)

Approaches (a) to (c) listed above are subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach (as discussed in Section 2.5).

As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified, such as the presence of mechanically cut peat, quaking peat, bog pools, sub peat water flow, slope characteristics and numerous other factors. The qualitative factors used in the risk assessment are compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRA (2017) and MacCulloch (2005).

The risk assessment uses the results of the deterministic approach in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to assess the risk of instability on a peat land site.

2.5 Peat Stability Assessment – Deterministic Approach

The peat stability assessment is carried out across a wide area of peatland to determine the stability of peat slopes and to identify areas of peatland that are suitable for development; this allows the layout of infrastructure on a particular wind farm site to be optimised. The assessment provides a numerical value (factor of safety) of the stability of individual parcels of peatland. The findings of the assessment discriminate between areas of stable and unstable peat, and areas of marginal stability where restrictions may apply. This allows for the identification of the most suitable locations for turbines, access roads and infrastructure.

A deterministic assessment requires geotechnical information and site characteristics which are obtained from desk study and site walkover, e.g. properties of peat/soil/rock, slope geometry, depth of peat, underlying strata, groundwater, etc. An adverse combination of the factors listed above could potentially result in instability. Using the information above a factor of safety is calculated for the stability of individual parcels of peatland on a site (as discussed in section 8).

The factor of safety is a measure of the stability of a particular slope. For any slope, the degree of stability depends on the balance of forces between the weight of the soil/peat working downslope (destabilising force) and the inherent strength of the peat/soil (shear resistance) to resist the downslope weight, see Figure 2-2.

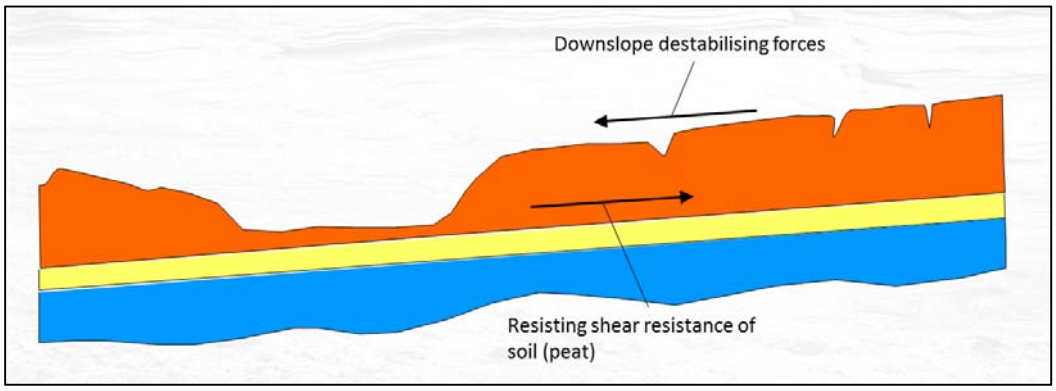


Figure 2-2: Peat Slope Showing Balance of Forces to Maintain Stability

The factor of safety provides a direct measure of the degree of stability of a slope and is the ratio of the shear resistance over the downslope destabilising force. Provided the available shear resistance is greater than the downslope destabilising force then the factor of safety will be greater than 1.0 and the slope will remain stable. If the factor of safety is less than 1.0 the slope is unstable and liable to fail. The acceptable result for factor of safety is 1.3 and above.

2.6 Applicability of the Factor of Safety (Deterministic) Approach for Peat Slopes

The factor of safety approach is a standard engineering approach in assessing slopes which is applied to many engineering materials, such as peat, soil, rock, etc.

The factor of safety approach is included in the Peat Landslide Hazard and Risk Assessments Best Practice Guide for Proposed Electricity Generation Developments (PLHRA, 2017); see section 5.3.1 of the guide. This guide provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

Furthermore, the best practice guide notes that the results from the factor of safety approach 'has provided the most informative results' with respect to analysing peat stability (section 5.3.1 of the guide).

The factor of safety approach in this report includes undrained (short-term stability) and drained (long-term stability) analyses. The undrained condition is the critical condition for the development. The purpose of the drained analysis is to identify the relative susceptibility of rainfall-induced failures at the site.

Notwithstanding the above, the stability analysis used by FT in this report also includes qualitative factors to determine the potential for peat stability i.e. the analysis used does not solely rely on the factor of safety approach.

The deterministic analysis is an acceptable engineering design approach. This concurs with the best practice guide referenced above.

2.7 Assessment of Intense Rainfall and Extreme Dry Events on the Peat Slopes

The deterministic approach carried out by FT examines intense rainfall and extreme dry events. The deterministic approach includes an undrained (short-term stability) and drained (long-term stability) analysis to assess the factor of safety for the peat slopes against a peat failure.

The drained loading condition applies in the long-term. This condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes. For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the peat slope.

In order to represent varying water levels within the peat slopes, a sensitivity analysis is carried out which assesses varying water level in the peat slopes i.e. water levels ranging between 0 and 100% of the peat depth is conducted, where 0% equates to the peat being completely dry and 100% equates to the peat being fully saturated.

By carrying out such a sensitivity analysis with varying water level in the peat slopes, the effects of intense rainfall and extreme dry events are considered and analysed. The results of this are presented in Section 8 of this report.

3 DESK STUDY

3.1 Desk Study

The main relevant sources of interest with respect to the site include:

- Literature review of peat failures/landslides
- Ordnance survey plans
- Geological plans and Geological Survey of Ireland database

The desk study also included a review of both published literature and GSI online dataset viewer (GSI, 2019) on peat failures/landslides in the vicinity of the site. In addition, this section of text includes commentary on a number of landslides within the proposed development of the wind farm which were inspected during the site walkover.

The Ordnance Survey Ireland (OSI, 2019) mapping/plans were reviewed to determine if any notable features or areas of particular interest (from a geotechnical or hydrology point of view) are present on the site.

The Geological Survey of Ireland (GSI, 1996) geological plans for the site were used to verify the bedrock conditions. The GSI (2019) database was used to verify soil and subsoil types on site.

3.2 Review of Previous Failures

The Lough Allen upland area has a high density of historical landslides (Pellicer, 2006), which are dominantly associated with peat failures from the plateau and surrounding steep slopes outside of the proposed development footprint (Figure 3-1).

A review of the historical landslides in the area indicates the following:

(1) All landslides (except 3 no.) in the area are located on the upland plateau or surrounding slopes.

(2) The landslides from the upland plateau and surrounding slopes are mostly peat slides, with occasional slumping of rock-soil at the steep margin of the plateau.

(3) The peat slides from the upland plateau and surrounding slopes have occurred due to mainly a combination of deeper (and weaker) peat on poorly drained sloping ground. Most of the slides have been triggered by intense rainfall events.

(4) Within the site, there are 3 no. landslides (Figure 3-1). These landslides are described as peat slides (2 no.) and a rotational slide (1 no.). The landslides appear to have been identified from aerial photography. These landslides were inspected by FT/AGEC during a site walkover and are discussed in Section 3.2.1.

Based on a broad assessment of landslide susceptibility the site is generally classified by the GSI (2019) as 'low' to 'moderately low' susceptibility, see Figure 3-1.

3.2.1 Historical Landslides on Site

The walkover inspection included the area of the 3 no. historical landslides within the site. The following observations are given:

(1) In the area of the recorded historical landslides, the inspection noted that the area was well-drained with a cover of heather over a shallow slope with a number of low-level topographic ridges.

(2) One of the historical failures identified is a rotational slide associated with minor erosion of a stream bank.

(3) The other two failures are located within hummocky well-drained terrain and it is not thought that these are actual peat slides. It is likely that these locations have been misidentified from the aerial photography based on the type of terrain present in the area.

(4) From the above, the historical peat slides comprise misidentified locations and minor slumping of a stream bank, and as such would not be indicators of peat instability on the site.

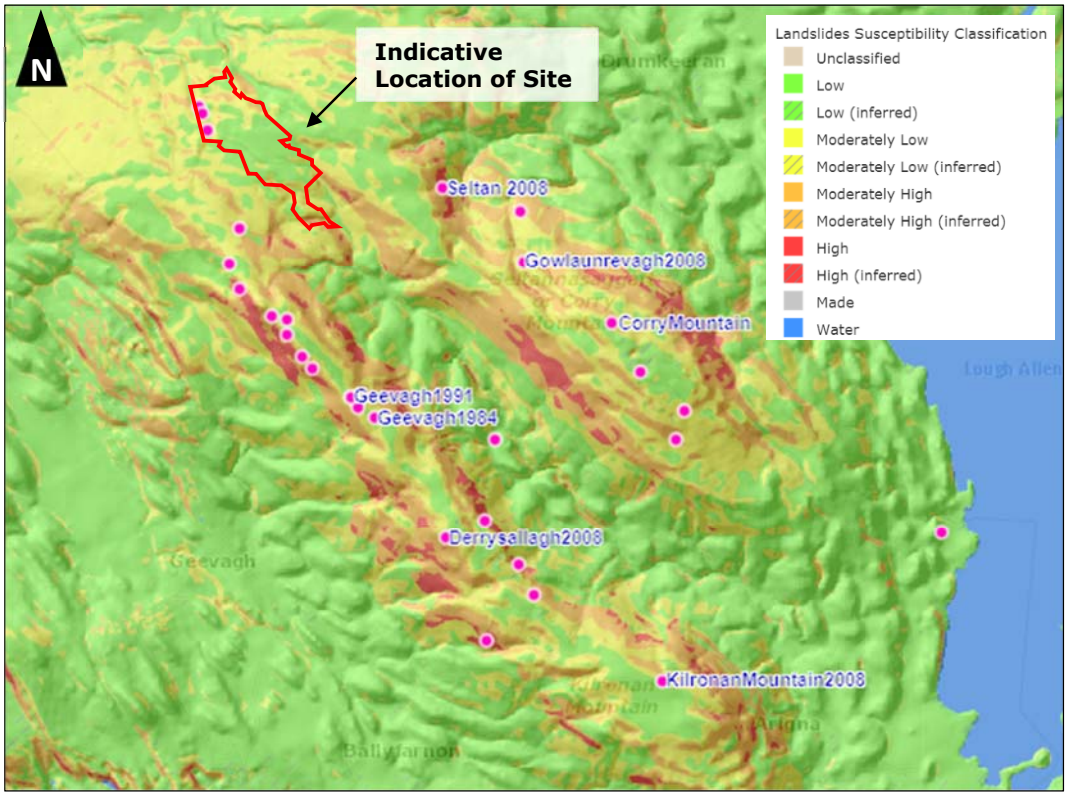


Figure 3-1: Plan showing landslide events and landslide susceptibility (GSI, 2019)

3.2.2 2016 Landslide

A landslide not yet included in the GSI database was identified during a previous walkover of the site by FT/AGEC, referred to hereafter as the 2016 landslide.

A previous walkover inspection identified a peat slide that occurred on the surrounding plateau slopes of Croagh to the southwest on the site in 2016. The slide travelled approximately 1km downslope and into the site (Figure 4-3). The peat slide originated on sloping ground within an area of peat cuttings outside the site boundary.

A combination of contributory factors for the peat slide are discussed in section 4.2 of this report. In summary, the likely cause of the failure was peat cutting using a 'sausage' machine in combination with high intensity rainfall in an area prone to failure. A number of previous peat failures have been related to 'sausage' cutting.

3.3 Review of OSI Mapping

The site is within the northwest part of the Lough Allen upland, which typically comprises plateau and ridges with steep sides separated by valleys. The proposed site is within the headwaters of the Arigna River valley which is situated between two upland plateaux ridges, namely Carrane Hill/Kilronan Mountain (437m OD) to the southwest and Corry Mountain (428m OD) to the northeast. The elevation at the site varies from 240 to 370m OD.

The site lies on the watershed divide between the Arigna River to the southeast and the Bonet River to the northwest. Lough Nacroagh, a small lochan some 150m long by about 30m wide, lies centrally within the site. The lochan is drained by a stream that flows to the northwest. The Arigna River rises on the site and flows to the southeast.

A number of streams drain the northern part of the site. These streams are generally linear through the site and drain in a northwest direction. Beyond the site, the streams pass across a drumlinised terrain and enter the Bonet River, located about 5km to the northwest, which flows into Lough Gill.

From a review of the OSI mapping for the area, no notable geotechnical features are recorded in the area.

3.4 Soils, Subsoil & Bedrock

From a review of the GSI (2019) database, the soils within the proposed development footprint consist predominantly of blanket peat and glacial till chiefly derived from Namurian sandstones and shales.

The peat is underlain by mineral soil comprising glacial till derived from Namurian bedrock.

The underlying bedrock was described by the Geological Survey of Ireland (GSI, 1996) and shown on Sheet 7 (Geology of Sligo-Leitrim). In the area of the Croagh site, Sheet 7 shows 4 no. bedrock formations.

The dominant bedrock formation is the Dergvone shale formation and is typically described as shale and minor turbiditic sandstone. The three remaining bedrock formations located within the proposed development footprint are Gowlaun shale formation, Lackagh sandstone formation and Carraun shale formation. Rock from the Gowlaun shale formation is typically described as dark grey silty sidenitic shale, from the Lackagh sandstone formation as cyclothemic sandstone, siltstone and coal and from Carraun shale formation is typically described as grey to black fossiliferous shale with subordinate micritic limestones and dolomites.

There is a mapped fault located in the south of the site with a southwest to northeast trend.

The bedrock is not affected by karst. No karst features were identified within the proposed development footprint; a number of karst features are located 2km southwest of the site and are recorded as swallow holes and caves.

Ironstones outcropping are present in the area but no evidence of workings are evident on the site.

Coal workings from mines and at-surface are located to the east and south-east of the site. No coal workings are present on the site.

3.5 Ground Conditions along Grid Connection Route

It is proposed to construct a substation within the site and to connect from here to the existing Garvagh substation. Connection will be via underground cabling located within existing forestry roads. The cabling route measures approximately 6.1km in total.

It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material. The trenches will be 900mm wide and 1220mm deep.

The cable trench route will encounter peat. No peat stability or geotechnical issues are expected as a result of the proposed grid connection works.

4 SITE WALKOVER

As part of the peat stability assessment at the proposed wind farm, numerous site walkovers were carried out by FT/AGEC between 2017 and 2019 with recording of salient geomorphological features with respect to the wind farm development and to provide peat thickness and preliminary assessment of peat strength.

The following salient geomorphological features were considered:

- Active, incipient or relict instability (where present) within the peat deposits
- Presence of shallow valley or drainage line
- Wet areas
- Any change in vegetation
- Peat depth
- Slope inclination and break in slope

The survey covered the proposed locations for the turbine bases, substation, met mast, temporary construction compounds, borrow pit, peat repositories, existing and proposed new access roads and all associated infrastructure.

The method adopted for carrying out the site walkover relied on practitioners carrying out a visual assessment of the site supplemented with peat depth probes, peat strength testing and measurement of slope inclinations.

4.1 Findings of Site Walkover for Wind Farm

The site walkover comprised numerous walkover inspections of the site by FT between 2017 and 2019. The findings from the site walkover have been used to optimise the layout of the infrastructure on site.

The main findings of the site walkover of the wind farm site is as follows:

(1) The site is covered in blanket peat and has undulating terrain. Peat depths vary across the site depending on mainly topography. As expected, deeper peat was encountered in the flatter areas of the site with thinner peat on the surrounding slopes. Young, mature forestry and areas of felled forestry are present across the site (see Appendix A – Photos 1 & 2).

(2) Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m (figure 4-1). Peat depths recorded across the site and outside the proposed infrastructure footprint from over 850 no. peat depth probes ranged from 0 to 8.2m with an average of 2.2m. The deeper peat areas were avoided when optimising the wind farm layout and main infrastructure elements for site.

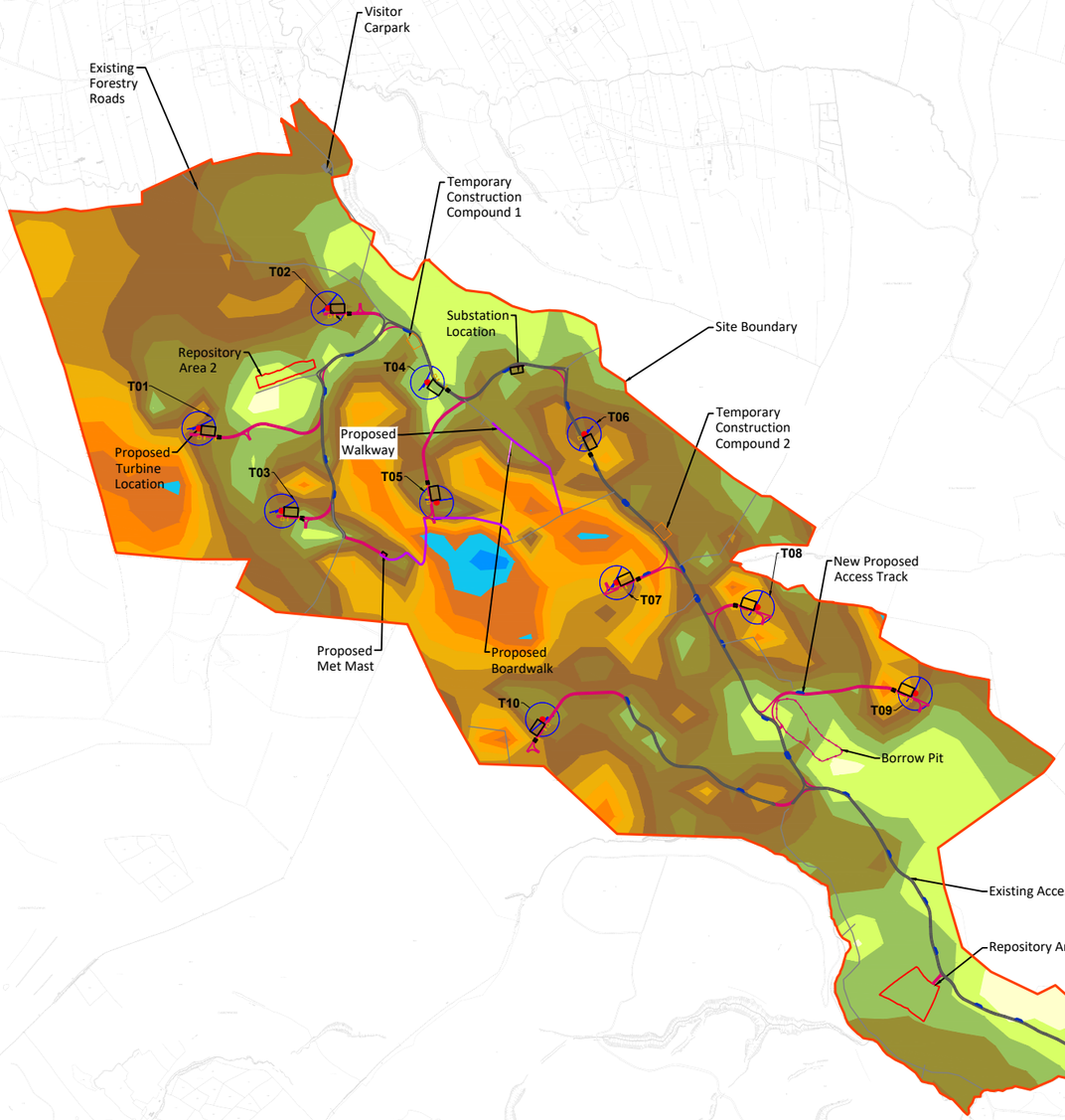
(3) The peat depths recorded at the turbine locations varied from 0.3 to 4.5m with an average depth of 2.0m. The slope angle at the turbine locations range from 2 to 12 degrees, locally up to 12 degrees where the peat depth is shallow.

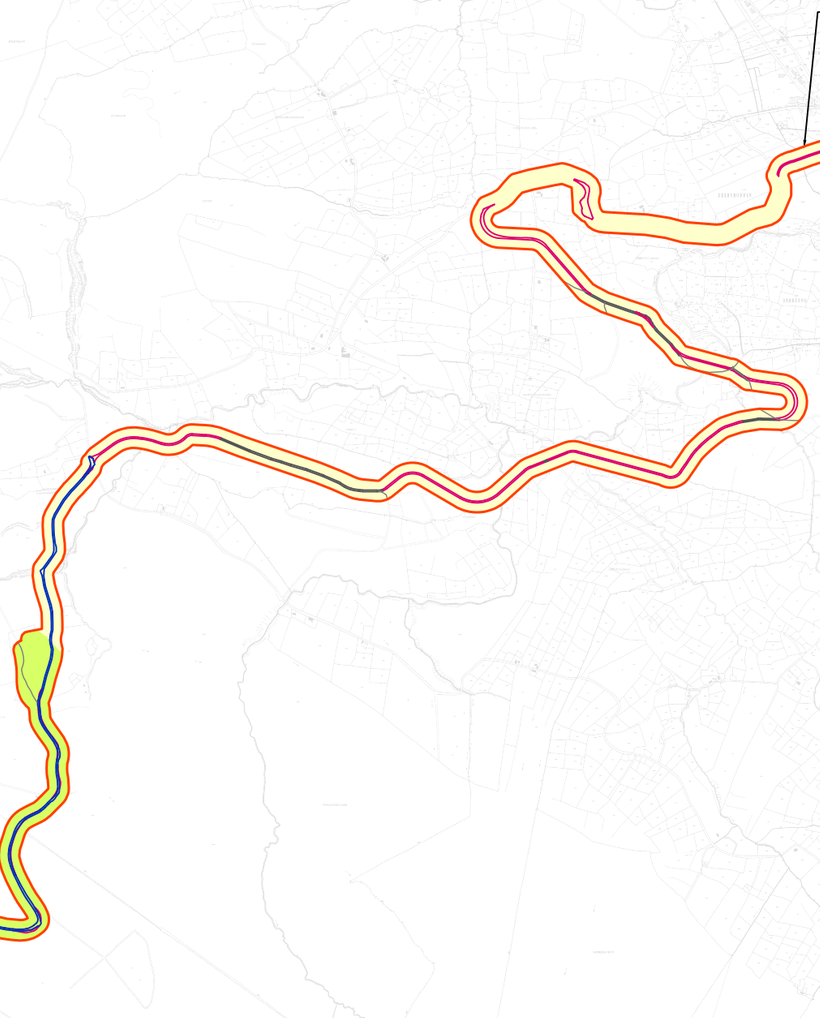
(4) The access tracks for the wind farm will comprise upgrading of existing and construction of new tracks. The existing tracks were noted as being in relatively good condition and consist of both excavated/founded and floated tracks. An example of the existing tracks are shown in Photos 6 and 7.

(5) With respect to the new proposed and existing tracks, peat depths are typically less than 3m with localised depths of up to 5m recorded.

(6) At a number of the deeper peat areas on site, quaking (or buoyant) peat was noted. Quaking peat is indicative of highly saturated peat, which would generally be considered to have a low strength. Quaking peat is a feature on sites that have been previously linked with peat instability. The areas identified as having quaking peat are highlighted on Figure 4-3 and were avoided when optimising/selecting infrastructure locations on site.

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Peat Depth Legend:

- ≥ 0 < 0.5
- ≥ 0.5 < 1
- ≥ 1 < 1.5
- ≥ 1.5 < 2
- ≥ 2 < 2.5
- ≥ 2.5 < 3
- ≥ 3 < 3.5
- ≥ 3.5 < 4
- ≥ 4 < 4.5
- ≥ 4.5 < 5
- ≥ 5 < 5.5
- ≥ 5.5 < 6
- ≥ 6 < 6.5

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale 1:24000

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FIGURE 4-1 : PEAT DEPTH CONTOUR PLAN

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(7) Mechanically cut peat is locally present in an area adjacent to the proposed location for turbine T1. Mechanically cut peat is typically cut using a sausage machine which is used to extract peat for harvesting. The machine cuts, which vary in depth essentially sever the acrotelm layer (upper fibrous layer of peat) where most of the intrinsic strength of peat lies. It should however be noted that the area where the mechanically cut peat is recorded as relatively flat, and that the works to construct T1 will not encroach on this area. The area is highlighted on Figure 4-3.

(8) Localised areas of ponding water were recorded on site. This is not unexpected given the ground conditions and the flat terrain present in localised areas across the site.

(9) A peat slide that occurred in 2016 on the surrounding plateau slopes of Croagh to the southwest of the site was inspected during the FT walkovers. An exclusion zone, where no development is recommended, around the landslide is shown on Figure 4-3. Section 4.2 of this report contains the main observations of the peat slide. In addition, see Photos 8 and 9 within Appendix A.

(10) A watercourse crossing is present along the proposed access route to turbine T1 (Photo 10). A suitably sized culvert with structural up-fill to allow the construction of the access road will be required at this location. See Chapter 4 of the EIAR for details.

(11) A summary of the site walkover findings for the wind farm are as follows:

(a) The site is typically covered in blanket peat with undulating terrain and widespread young, mature and felled forestry. Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m (figure 4-1).

(b) A construction buffer zone plan has been produced for the site (Figure 4-3). This Figure shows areas on the site where no development is proposed and areas with an elevated or higher construction risk. The above identified areas are based on qualitative factors identified during the walkover survey e.g. relatively deep peat, quaking peat, mechanically cut peat, historic peat landslides, etc.

(c) The results of the peat depth probing, shear strength testing of the peat and qualitative factors identified on site have been used in the stability and risk assessment, see sections 7 and 8 of this report.

4.2 Findings of Site Walkover for 2016 Landslide

The landslide of October 2016 identified during a previous walkover of the site by FT/AGEC was inspected during the site walkovers (Photos 8 and 9). The following findings from the site walkover are given:

(1) The slide travelled approximately 1km downslope, away from any forestry, and into the proposed Croagh wind farm site. The peat slide originated on sloping ground within an area of mechanically cut peat outside the site boundary.

(2) Based on anecdotal information from a local landowner, the failure/landslide is thought to have occurred in October 2016.

(3) Peat thicknesses recorded at the head of the failure typically ranged from 2.2 to 2.5m.

(4) Based on an inspection of the shear plane/failure surface, the failure is thought to have occurred within the silt/clay underlying the peat deposits. Photo 8 shows the failure surface.

(5) Following a review of the failure source area, an estimated plan area of 25,000m^2 with a typical peat depth of 2.3m is given. This gives an estimated failure volume of 57,500m^3. It should be noted that further material within the scar and downslope of the initial the scar is likely to have been mobilised during the failure. As an approximate guide the potential volume mobilised downslope of the failure source area could be in excess of 18,000m^3 (assumed 900m length, 20m width and 1m peat depth).

(6) It should be noted that the failed material was deposited along the edges of the failure scar, within the failure and towards the end of the failure run-off.

(7) The following combination of contributory factors to the peat slide are as follows:

(a) Peat cutting. 'Sausage' machine cutting was carried out within the source area of the failure. This cutting severs particularly the upper fibrous layer (acrotelm) reducing shear strength and allows ingress of surface water. The peat appears to have been cut in multiple directions.

(b) Drainage. Several ditches drain into the area, including a downslope drain that feeds directly into the head of the failure.

(c) Previous failures. The area of the 2016 slide corresponds with a notable break (step) in the peat cover along the slope. This is identified further south as an historical 'peat burst'. It is likely that this break in the peat cover represents the back-scarp to previous multiple peat slides. At the location of the 2016 slide the break in peat cover extended downslope as a spur of peat, this spur failed in the slide.

(d) Rainfall. High intensity rainfall is usually associated with such failures. A review of rainfall data shows no significant rainfall in October 2016 based on data from Markree Rainfall Station in Sligo. The possibility of a localised rainfall event at the site cannot however be discounted.

(8) In summary, the likely major contributory causes of the failure were peat cutting using a 'sausage' machine in combination with high intensity rainfall in an area prone to failure.

4.3 Findings of Walkover for Upland Slopes (outside of site boundary)

A walkover survey of the upland slopes outside of the Croagh wind farm site boundary was carried out on 26th and 27th October 2017. The upland slopes outside of the proposed development covered by the FT/AGEC walkover are shown on Figure 4-2.

The walkover findings presented in this section of the report have been separated into the following upland slopes (both of which are outside the proposed site boundary for the Croagh site):

(1) Southwestern upland slopes

(2) Eastern upland slopes

4.3.1 Southwestern Upland Slopes

The following findings were recorded from the site walkover:

(1) The upland slopes to the southwest of the development boundary are covered in blanket peat with peat depths ranging from 0.7 to 4.5m with an average of 3m.

(2) Areas of mechanically cut and cut-over peat are present on the slopes. In some cases, the peat has been cut in a direction parallel to the slope contours which encourages water to build-up within the mechanical cuts. This area is highlighted and further discussed below.

(3) There is evidence of relict (likely multiple) failures along the slope.

(4) A peat slide which occurred in 2016 is present on the slope. The slide travelled approximately 1km downslope into the proposed footprint of the Croagh wind farm site, as described in Section 4.2. The likely cause of the failure was peat cutting using a 'sausage' machine in combination with high intensity rainfall in an area prone to failure.

(5) Given the high density of relict failures and the 2016 failure noted on the south-western slopes, the risk of peat instability/failure on the remaining areas of the slope is considered medium risk provided the natural state of the peat slopes remains unchanged i.e. no construction works, change in drainage regime or similar activities take place on the slopes. However, as stated above, this area is outside of the site boundary and as such no works are proposed in this area.

4.3.2 Eastern Upland Slopes

The following findings were recorded from the site walkover:

(1) The upland slopes to the east of the site boundary are covered in blanket peat with peat depths ranging from 0.9 to in excess of 7.5m with an average of 3.3m. The deeper peat was encountered in the flatter areas with thinner peat on the steeper surrounding slopes.

(2) Quaking peat was noted at a number of the deeper peat areas. Quaking peat has previously been linked with peat instability/failure however with the presence of the flat terrain in these areas, the risk of peat failure is considered low.

(3) No significant signs of previous peat instability/failure were noted on the slopes.

(4) Notwithstanding the significantly deep peat recorded on the eastern slopes, the risk of peat instability/failure in this area is low provided the natural state of the peat slopes remains unchanged i.e. no construction works, change in drainage regime or similar activities take place on the slopes. The low risk in the deeper peat areas is attributed to the flat terrain present.

(5) Where construction works are proposed within this area, the implementation of appropriate construction measures will maintain a low risk of peat instability.

It should be noted that the findings presented above are based on the condition of the slopes at the time of the FT/AGEC site inspection. Alterations to the surrounding slopes such as construction activities, change in the drainage regime, harvesting of peat, etc, can change the condition and stability of the slopes.

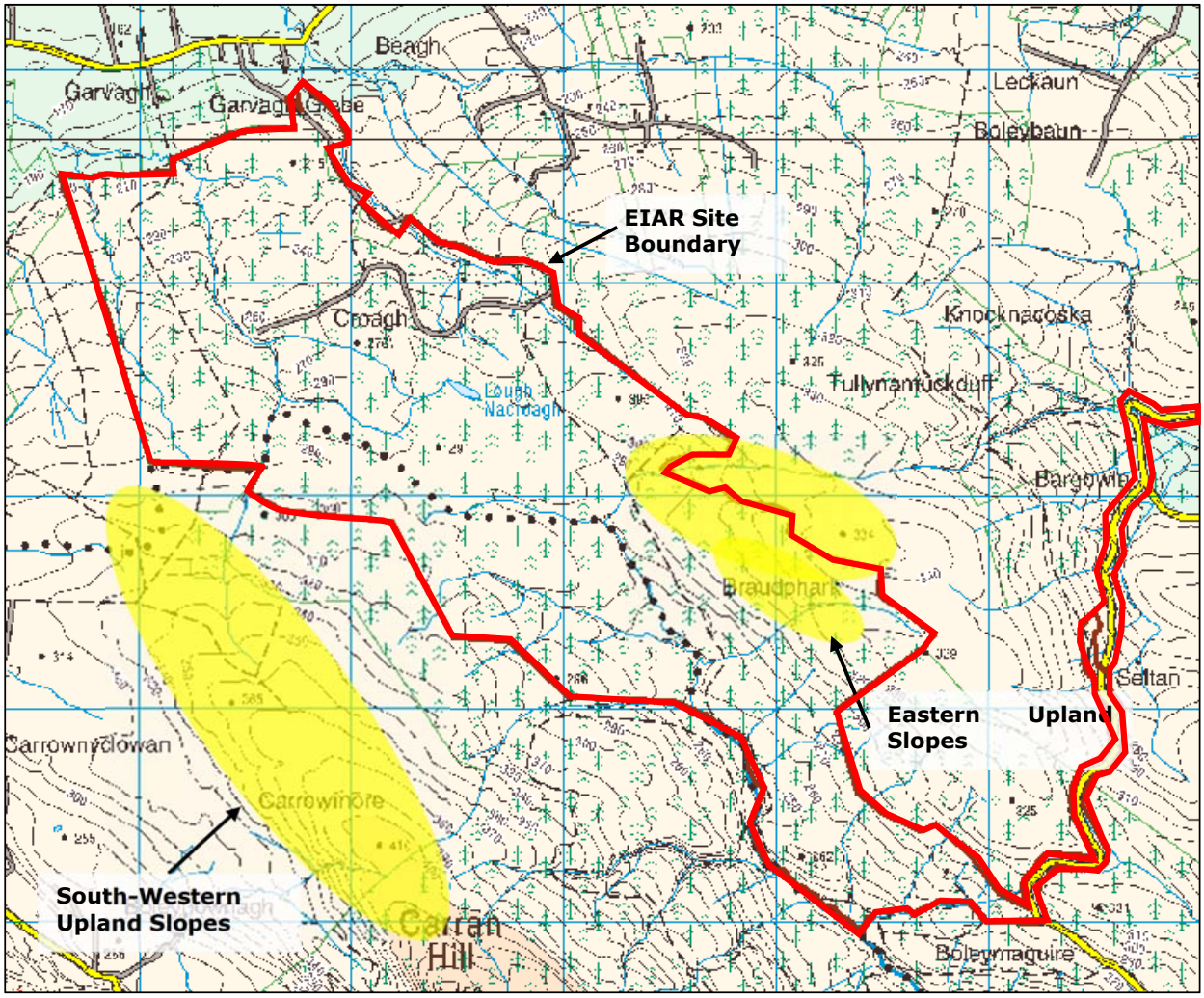


Figure 4-2: Indicative extent of adjacent upland slopes inspected by FT

Legend

Indicative extent of adjacent upland slopes inspected by FT

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Existing Forestry Roads
Visitor Carpark
Temporary Construction Compound 1
Substation Location
Site Boundary
Repository Area 2
Proposed Turbine Location
Proposed Walkway
Temporary Construction Compound 2
New Proposed Access Track
Proposed Met Mast
Proposed Boardwalk
Borrow Pit
Existing Access Track
Repository Area 1
T01
T02
T03
T04
T05
T06
T07
T08
T09
T10

Site Boundary

Construction Buffer Zone Legend:

Areas which have an elevated or higher construction risk (areas with deep weak and occasionally quaking peat). Areas where no development is proposed.

Area of 2016 peat slide where no development is proposed.

Areas which have an elevated or higher construction risk (area with mechanically cut peat). Area where no development is proposed.

Areas which have an elevated or higher construction risk. Marginally low FOS calculated, see section 7 of report for futher details.

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale 1:24000

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FIGURE 4-3 : CONSTRUCTION BUFFER ZONE PLAN

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Friday 3 July 2020

5 GROUND INVESTIGATION

A number of phased ground investigations were carried out at the site by FT/AGEC, National Material Testing Laboratory (NMTL) and Irish Drilling Ltd (IDL). A summary of the ground investigation is presented below.

Table 5-1: Summary of Geotechnical Parameters

Investigation Type	Number
Peat Probe	850
Hand Shear Vane	54
Trial Pit	40
Borehole	4

The initial phase of ground investigation comprised 11 no. trial pits and was carried out on 24th and 25th October 2017. Laboratory testing of samples was carried out by NMTL. A 13-tonne tracked excavator was used for the ground investigation works. The trial pits were carried out at various locations across the site to depths of 4.4m bgl. The laboratory testing comprised classification testing of the soft silt/clay underlying the peat. The trial pit logs, photographs and laboratory test results from the 2017 ground investigation are included in Appendix B.

The second phase of ground investigation comprised 21 no. trial pits and was carried out on 29th April and 2nd May 2019 and 29th and 30th May 2019. Laboratory testing of samples was carried out by IDL. A 13-tonne tracked excavator was used for the ground investigation works. The trial pits were carried out at various locations across the site to depths of 4.4m bgl. The laboratory testing comprised classification and density testing of the non-peat overburden deposits. The trial pit logs, photographs and laboratory test results from the 2019 ground investigation (trial pits) are included in Appendix C.

The third phase of ground investigation comprised 4 no. boreholes/rotary cores and were carried out between 28th May and 13th June 2019. Laboratory testing of samples was carried out by IDL. The boreholes/rotary cores were carried out at potential borrow pit locations across the site to depths of 30m bgl. The laboratory testing comprised strength and reusability testing of rock core recovered. In-situ standard penetration testing (SPT) was carried out in the non-peat overburden at typically 1.5m intervals. In-situ permeability testing was also carried out at each of the boreholes. The borehole/rotary core logs, photographs and laboratory and in-situ test results from the 2019 ground investigation are included in Appendix D.

Two trial pits were excavated under the supervision of MKO at potential borrow pit locations in September 2019. An additional 6 no. trial pits were excavated along the construction access route in March 2020.

The purpose of the ground investigations was to assess the ground conditions across the site in particular the extent, characteristics and strength of the soil immediately underlying the peat, to determine the potential founding stratum of various infrastructure elements across the site and to determine the potential to develop borrow pits at the site.

The ground investigations were carried out in accordance with the principles in BS 5930:2015 and Eurocode 7 Part 2. A ground investigation location plan showing all trial pit and borehole locations is included as Figure 5-2 in this report.

5.1 Summary of In-situ & Laboratory Tests

As part of the 3 no. phases of ground investigation carried out at the site, laboratory testing was carried out as part of the works. The laboratory testing carried out included:

- Soil classification tests
- Soil density tests
- Rock strength tests

- Rock reusability tests

Laboratory testing was scheduled on bulk samples recovered from the trial pits and rock core recovered from the boreholes/rotary cores.

Particle size distribution (PSD) tests and Atterberg limit classification tests were carried out on samples from the trial pits. The PSD tests showed that the material is a slightly gravelly slightly sandy clayey Silt/silty Clay based on the percentage of the particle sizes. The Atterberg limit test results show the material as either a clay or silt of low to intermediate plasticity.

5.2 Interpretation & Summary of Ground Conditions

The ground conditions and stratigraphy at the site can be typically categorised into the following sequence:

Peat

Typically described as firm and spongy locally plastic black & brown fibrous to amorphous peat. Peat thicknesses from the trial pits ranged from 0.3 to 4.2m.

Soft Silt/Clay Deposit

Described as very soft and soft, locally firm, light brown/grey clayey silt. The thickness of the layer generally varies from 0.3 to 0.6m, locally up to 0.8m, with an average thickness of 0.5m. The soft silt/clay deposit was recorded in all but one of the 15 no. trial pits. This layer is locally known as 'Leitrim daub'.

Undrained shear strength recordings within this layer range from 6 to 51 with an average of 25kPa. Locally a number of relatively higher strength readings (greater than 40kPa) were recorded.

The soft silt/clay deposit frequently has a lower strength than the overlying peat. No clear separation was noted between the soft silt/clay deposit and the overlying peat.

This material would be unsuitable as a founding stratum for all infrastructure elements on site e.g. access tracks, hardstands, turbine bases, etc.

Glacial Till

Described as firm and stiff, locally very stiff, sandy very gravelly silt/clay with occasional to frequent cobbles and locally occasional boulders. Cobbles and boulders were typically noted as angular and sub-rounded and rounded. The thickness of the layer is variable across the site depending on topography and depth to bedrock. The base of the glacial till was not encountered in most of the trial pits; noted as "not bottomed out' in trial pits logs.

Gravel and cobbles comprised fragments of weathered shale. The till is essentially derived from the underlying Namurian sandstones and shales.

The till would be suitable for a founding stratum for some of the infrastructure elements on site e.g. access tracks, hardstands, etc.

SPT 'N' values within this layer ranged from 5 to 50 (refusal), indicating a strength range of soft to very stiff.

Bedrock

Possible weathered bedrock was encountered in 2 of the 15 no. trial pits (TP6 & TP13) and was typically described as highly weathered grey/blue shale.

The weathered shale rock recovered during the ground investigation is considered poor quality shale based on its physical properties from a visual inspection. Higher quality rock is likely to be present at depth.

Bedrock was recovered from rotary boreholes drilled at 4 no. locations across the site to provide an overview and comprised a medium strong thinly laminated fine-grained Limestone with closely spaced horizontal and

subvertical discontinuities. A medium strong thinly laminated calcareous Siltstone with closely to very closely spaced discontinuities was also recorded.

Rock strength and durability testing was undertaken on core samples taken from the four boreholes. A single Uniaxial Compressive Strength (UCS) test was carried out on a sample from BH3 and recorded a strength of 80MPa (strong). Five sets of Point Load Index (PLI) testes were undertaken on rock core samples. Each set comprised five tests, with strengths ranging from 0 to 1.9MPa (very weak to medium strong).

A total of six number Los Angeles abrasion tests were carried out on samples from the rotary boreholes, with results ranging from 33 to 48.

A total of three Slake Durability tests were carried out with results ranging from 70.5 to 98.3%. A total of three Magnesium Sulphate Soundness tests were undertaken with results ranging from 55 to 91.

Groundwater & Permeability

Groundwater monitoring locations were installed in the 4 no. rotary boreholes. Groundwater readings ranged from 1.76 in BH4 to 12.56m bgl in BH2.

Two rising head and two falling head permeability tests were undertaken in the boreholes.

Other Comments and Observations

The stability of the excavation faces of the trial pits was frequently noted as unstable.

5.3 Overview of Ground Conditions

The site is covered with blanket bog. Based on in excess of 850 probes carried out during previous walkover surveys the peat depth ranged from 0 to 6.0m with an average peat depth from probes of 1.7m.

Peat depths vary across the site depending on mainly topography. Generally deeper peat was encountered in the flatter areas of the site with thinner peat on sloping ground. Localised variations in peat depth over short distances were recorded, which reflects the undulations in the underlying surface of the mineral soil/rock topography.

The peat is immediately underlain by a soft silt/clay deposit and glacial till derived from Namurian sandstones and shales. The soft silt/clay deposit appears to be present across the site. Based on a desk study, bedrock on the site comprises dominantly shale with interbedded minor sandstone. Bedrock recorded in the rotary boreholes was a mixture of fine-grained Limestone and calcareous Siltstone

5.4 Summary of Geotechnical Parameters

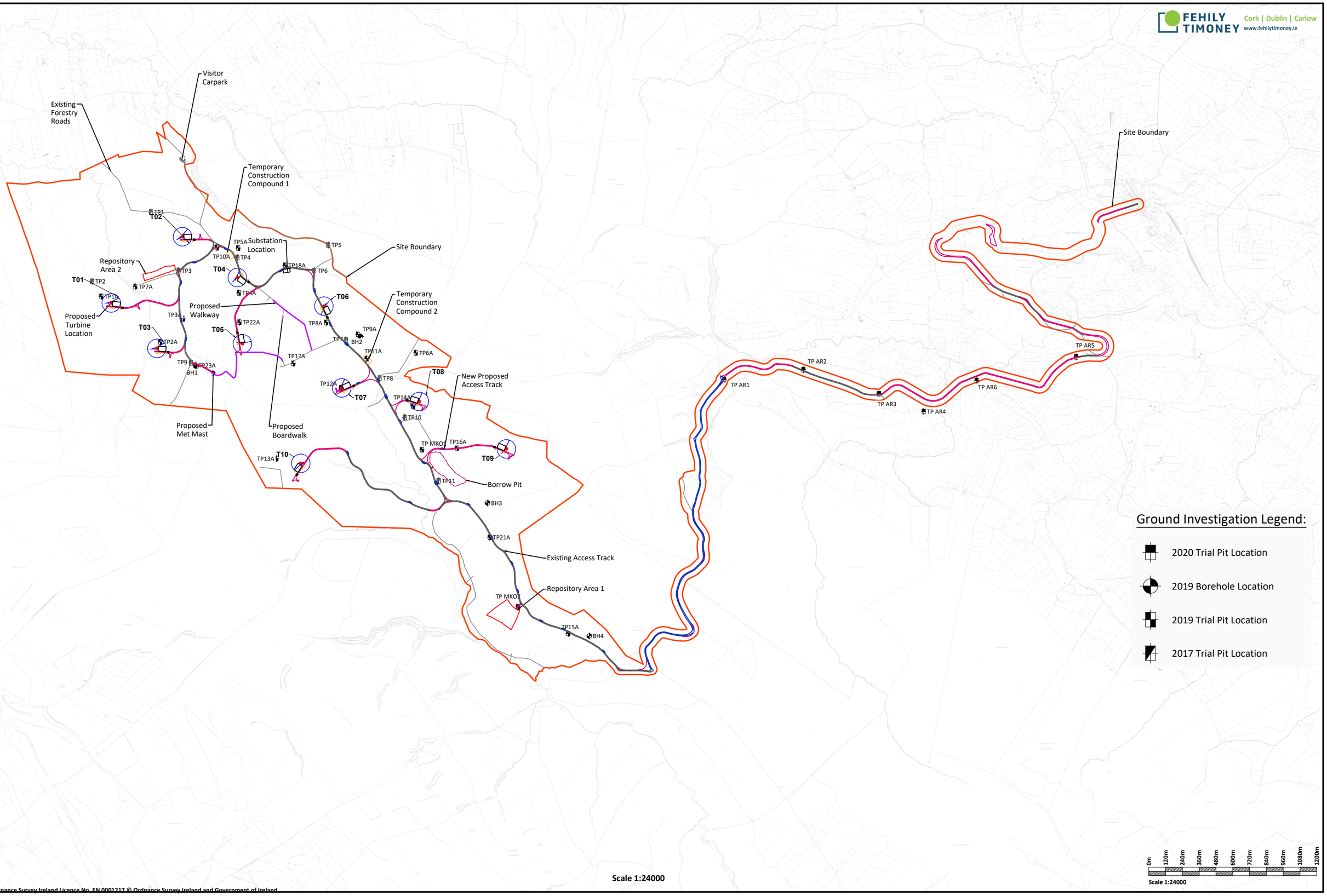
Table 5-1 contains characteristic geotechnical parameters for the main material types likely to be encountered on the Croagh Wind Farm site. Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values. Characteristic values are defined as a cautious estimate of the value affecting the occurrence of limit state based on clause 2.4.5.2 from Eurocode 7.

Table 5-2: Summary of Geotechnical Parameters

Material Type/Strata	Unit Weight	Geotechnical Parameters		
		Undrained Parameters	Drained Parameters	
	γ (kN/m^3)	c_u (kPa)	φ' (°)	c' (kPa)
Peat	11	6	25	4
Soft Silt/Clay	18	20	26	0
Glacial Till	19	75	30	0
Bedrock	21	-	34	250

Notes
Note (1) The above parameters are indicative only and have been derived based on experience and from a review of the ground investigation carried out at the site.
Note (2) Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values.

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FIGURE 5-1 : GROUND INVESTIGATION LOCATION PLAN

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Friday 3 July 2020

6 PEAT DEPTH, STRENGTH & SLOPE AT PROPOSED INFRASTRUCTURE LOCATIONS

Based on the peat depths recorded within the proposed infrastructure envelope by FT/AGEC, HES and MKO, the peat varied in depth from 0 to 6m with an average of 1.7m. All peat depth probes (in excess of 850 no. probes) carried out on site have been utilised to produce a peat depth contour plan for the site (Figure 4-1).

A summary of the peat depths at the proposed infrastructure locations is given in Table 6-1. The data presented in Table 6-1 is used in the peat stability assessment of the site; see Section 7 of this report.

Table 6-1: Peat Depth & Slope Angle at Proposed Infrastructure Locations

Turbine	Easting	Northing	Peat Depth Range (m) (1) (4)	Average Peat Depth (m)	Slope Angle (o) (2)
T1	583322	823639	1.8 to 2.2	2.0	3
T2	583831	824112	1.8 to 2.8	2.4	2
T3	583648	823314	1.9 to 2.8	2.2	2
T4	584223	823820	0.5 to 1.0	0.8	12
T5	584259	823347	0.3 to 1.3	0.8	2
T6	584841	823616	1.8 to 2.4	2.0	2
T7	584968	823032	2.0 to 2.8	2.4	4
T8	585523	822935	3.3 to 3.9	3.5	4
T9	586144	822595	2.1 to 4.5	3.2	3
T10	584676	822493	0.8 to 1.0	0.9	6
Substation	584584	823867	0.9 to 1.7	1.2	6
Temporary Construction Compound 1	584170	823980	0.7 to 1.6	1.2	12
Temporary Construction Compound 2	585150	823232	1.3 to 1.9	1.6	5
Met Mast	584059	823136	0.6 to 1.5	1.2	3
Borrow Pit	585697	822449	Typ. 0.5	0.5	4-12
Repository Area 1	586141	821416	1 to 1.5	1.25	1-4
Repository Area 2	583669	823855	0.9 to 1.5	1.2	6-10

Note (1) Based on probe results from the site walkovers. The range of peat depths for the infrastructure locations are generally based on a 10m grid carried out around the infrastructure element.
Note (2) Slope angle obtained during site survey by FT using handheld equipment or from slope contour survey data. The slope angle quoted reflects the slope immediately around the infrastructure location.
Note (3) The data presented in the Table above is used in the peat stability assessment of the site; see Section 8 of this report.

In addition to probing, in-situ shear vane testing was carried out as part of the ground investigation. Strength testing was carried out at selected locations across the site to provide representative coverage of indicative peat strengths. The results of the vane testing are presented in Figure 6-1.

The hand vane results indicate undrained shear strengths in the range 5 to 45kPa, with an average value of about 18kPa. The lower bound strengths recorded would be typical of deep weak saturated peat and were recorded in the deeper peat deposits in the flatter areas of the site.

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from essentially back-analysis, though some testing was carried out, was estimated at 2.5kPa.

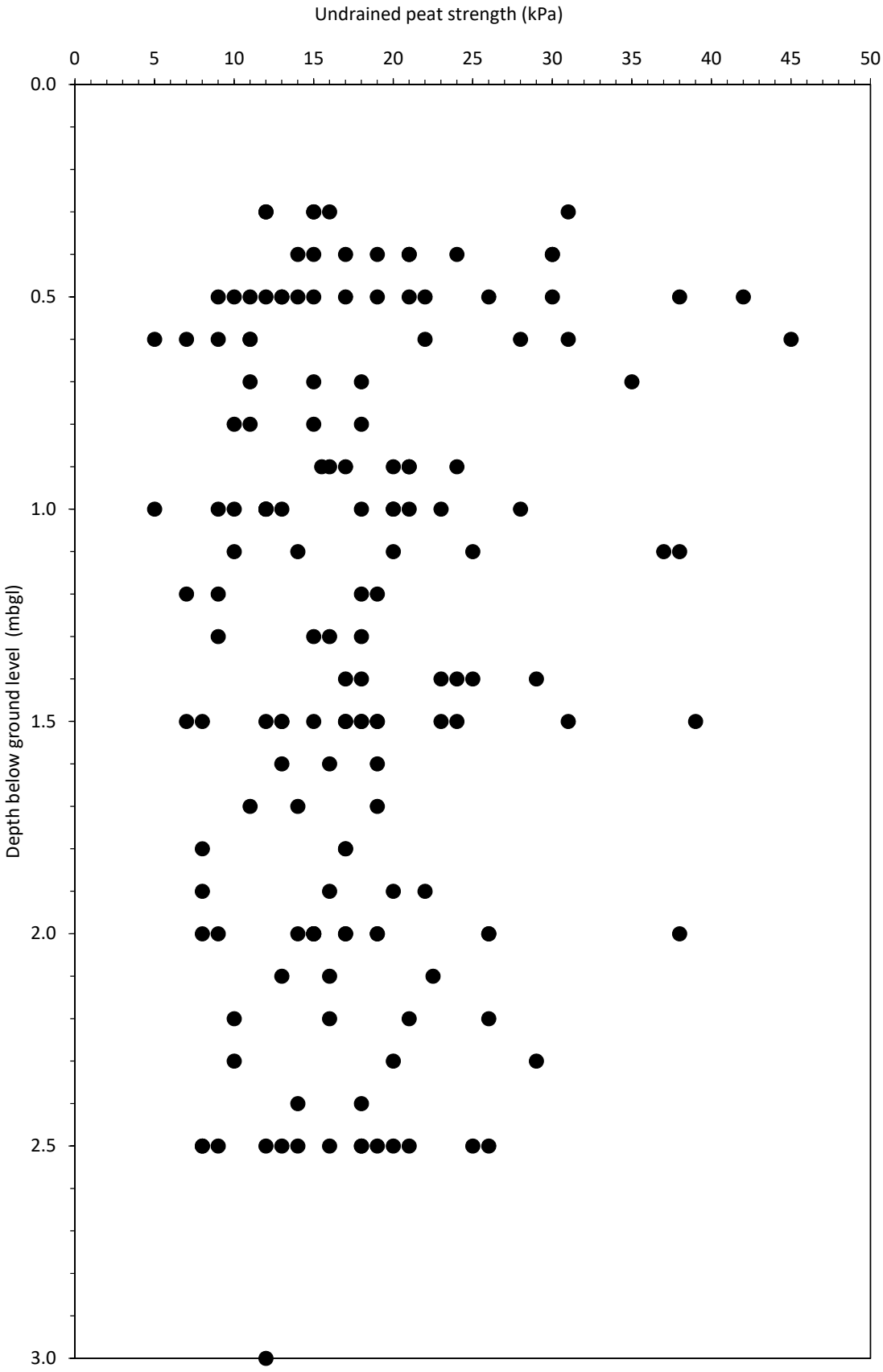


Figure 6-1: Undrained shear strength (C_u) profile for peat with depth

7 PEAT STABILITY ASSESSMENT

The peat stability assessment analyses the stability of the natural peat slopes for individual parcels across the site including at the turbine locations, along the proposed access roads, at the other main infrastructure elements and at various locations across the site. The assessment also analyses the stability of the natural peat slopes with a surcharge loading of 10kPa, equivalent to placing 1m of stockpiled peat on the surface of the peat slope.

7.1 Methodology for Peat Stability Assessment

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure and loading conditions.

An adverse combination of factors could potentially result in peat sliding. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To assess the factor of safety for a peat slide, an undrained (short-term stability) and drained (long-term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

1. The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.
2. The drained loading condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

Undrained shear strength values (c_u) for peat are used for the total stress analysis. Based on the findings of the 2003 Derrybrien failure, and other failures in peat, undrained loading during construction was found to be the critical failure mechanism.

A drained analysis requires effective cohesion (c') and effective friction angle (ø') values for the calculations. These values can be difficult to obtain because of disturbance experienced when sampling peat and the difficulties in interpreting test results due to the excessive strain induced within the peat. To determine suitable drained strength values a review of published information on peat was carried out.

Table 7-1 shows a summary of the published information on peat together with drained strength values.

Table 7-1: List of Effective Cohesion and Friction Angle Values

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus/ Comments
Hanrahan et al (1967)	5 to 7	36 to 43	From triaxial apparatus
Rowe and Mylleville (1996)	2.5	28	From simple shear apparatus
Landva (1980)	2 to 4	27.1 to 32.5	Mainly ring shear apparatus for normal stress greater than 13kPa
	5 to 6	-	At zero normal stress
Carling (1986)	6.5	0	-

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus/ Comments
Farrell and Hebib (1998)	0	38	From ring shear and shear box apparatus. Results are not considered representative.
	0.61	31	From direct simple shear (DSS) apparatus. Result considered too low therefore DSS not considered appropriate
Rowe, Maclean and Soderman (1984)	1.1	26	From simple shear apparatus
	3	27	From DSS apparatus
McGreever and Farrell (1988)	6	38	From triaxial apparatus using soil with 20% organic content
	6	31	From shear box apparatus using soil with 20% organic content
Hungr and Evans (1985)	3.3	-	Back-analysed from failure
Dykes and Kirk (2006)	3.2	30.4	Test within acrotelm
Dykes and Kirk (2006)	4	28.8	Test within catotelm
Warburton et al (2003)	5	23.9	Test in basal peat
Warburton et al (2003)	8.74	21.6	Test using fibrous peat
Hendry et al (2012)	0	31	Remoulded test specimen
Komatsu et al (2011)	8	34	Remoulded test specimen
Zwanenburg et al (2012)	2.3	32.3	From DSS apparatus
Den Haan & Grognet (2014)	-	37.4	From large DSS apparatus
O'Kelly & Zhang (2013)	0	28.9 to 30.3	Tests carried out on reconstituted, undisturbed and blended peat samples

From Table 7-1 the values for c' ranged from 1.1 to 8.74kPa and ø' ranged from 21.6 to 43°. The average c' and ø' values are 4.5kPa and 30° respectively. Based on the above, it was considered to adopt a conservative approach and to use design values below the averages.

For design the following general drained strength values have been used for the site:

$c' =$ 4kPa
$ø' =$ 25 degrees

7.2 Analysis to Determine Factor of Safety (Deterministic Approach)

The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes using infinite slope analysis. The analysis was carried out at the turbine locations, along the proposed access roads, at the other main infrastructure elements and at various locations across the site.

The FoS provides a direct measure of the degree of stability of the slope. A FoS of less than unity indicates that a slope is unstable, a FoS of greater than unity indicates a stable slope.

The acceptable safe range for FoS typically ranges from 1.3 to 1.4. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981), provided advice on design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation the design FoS should be greater than 1.3.

As a general guide the FoS limits for peat slopes in this report are summarised in Table 7-2.

Table 7-2: Factor of Safety Limits for Slopes

Factor of Safety (FoS)	Degree of Stability
Less than 1.0	Unstable (red)
Between 1.0 and 1.3	Marginally stable (yellow)
1.3 or greater	Acceptable (green)

Eurocode 7 (EC7) (IS EN 1997-1:2005) now serves as the reference document and the basis for design geotechnical engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances. Unlike the traditional approach, EC7 does not provide a direct measure of stability, since global Factors of Safety are not used.

As such, and in order to provide a direct measure of the level of safety on a site, EC7 partial factors have not been used in this stability assessment. The results are given in terms of FoS in order to provide a direct measure of the level of safety at specific points on the site.

A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment based on the c_u values recorded at the site. It should be noted that a c_u of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat generally has a higher undrained strength.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

Where,

F = Factor of Safety
cu = Undrained strength
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
a = Slope angle

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2\alpha \tan\phi'}{\gamma z \sin\alpha \cos\alpha}$$

Where,

F = Factor of Safety
c' = Effective cohesion
γ = Bulk unit weight of material

z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
α = Slope angle
ϕ' = Effective friction angle

For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the slope. Since the water level in blanket peat can be variable and can be recharged by rainfall, it is not feasible to establish its precise location throughout the site. Therefore, a sensitivity analysis using water level ranging between 0 and 100% of the peat depth was conducted, where 0% equates to the peat been completely dry and 100% equates to the peat been fully saturated.

The following general assumptions were used in the analysis of peat slopes at each location:

(1) Peat depths are based on the maximum peat depth recorded at each location from the walkover surveys carried out by FT/AGEC, MKO and HES.
(2) A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment based on the c_u values recorded at the site. It should be noted that a c_u of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat generally has a higher undrained strength.
(3) Slope angle on base of sliding assumed to be parallel to ground surface.

For the stability analysis two load conditions were examined, namely;

Condition (1): no surcharge loading
Condition (2): surcharge of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case.

7.3 Results of Analysis

7.3.1 Undrained Analysis for the Peat

The results of the undrained analysis for the natural peat slopes are presented in Appendix F and the results of the undrained analysis for the most critical load case (load condition 2) are shown on Figure 7-1. The undrained analysis for load condition 2 is considered the most critical load case as most peat failures occur in the short term upon loading of the peat surface. The results from the main infrastructure locations are summarised in Table 7-3.

The calculated FoS for load condition (1) is in excess of 1.30 for each of the 332 no. locations analysed with a range of FoS of 1.53 to in excess of 10, indicating a low risk of peat instability.

The calculated FoS for load condition (2) for the 332 no. locations analysed, only 7 no. FoS points were less than 1.3 where FoS's of 1.05 and 1.28 were calculated. In relation to the marginally low FoS's, 6 no. of the FoS points are located alongside existing access roads on site which have been in operation for a number of years and hence are not considered areas at risk of peat instability. However, these areas have an elevated construction risk and are highlighted on the construction buffer zone plan (Figure 4-3).

Areas with marginally low FoS's frequently coincide with steeper slope angles of between 7.6 and 12.1 degrees or localised deeper pockets of peat. The slope angles are based on lidar survey data for the area and the steeper slope angles calculated are likely as a result of localised undulations or variations in vegetation at those particular locations. Applying slope angles reflective of site conditions at these locations in the assessment would likely result in FoS's greater than 1.3 in these areas.

The remaining 1 no. marginally low FoS is located along the new proposed access road to turbine T9 and coincides with a deeper pocket of peat. This area has an elevated construction risk and is highlighted on the construction buffer zone plan (Figure 4-3). This location is subject to additional control and mitigation measures as per the adjacent turbine T9 (Appendix E).

The remainder of the locations analysed had acceptable FoS's of greater than 1.3, indicating a low risk of peat instability.

Table 7-3: Factor of Safety Results (Undrained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	583322	823639	5.22	3.59
T2	583831	824112	6.14	4.53
T3	583648	823314	6.14	4.53
T4	584223	823820	2.95	1.48
T5	584259	823347	13.23	7.48
T6	584841	823616	7.17	5.06
T7	584968	823032	11.16	8.23
T8	585523	822935	2.39	1.90
T9	586144	822595	2.55	2.09
T10	584676	822493	5.77	2.89
Substation	584584	823867	13.69	5.13
Temporary Construction Compound 1	584170	823980	3.84	1.92
Temporary Construction Compound 2	585150	823232	3.87	2.19
Met Mast	584059	823136	20.78	7.79

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Existing Forestry Roads
Visitor Carpark
Temporary Construction Compound 1
Substation Location
Site Boundary
Repository Area 2
Proposed Turbine Location
Proposed Walkway
Temporary Construction Compound 2
New Proposed Access Track
Proposed Met Mast
Proposed Boardwalk
Borrow Pit
Existing Access Track
Repository Area 1
T01
T02
T03
T04
T05
T06
T07
T08
T09
T10

Site Boundary

Factor of Safety Legend:

0 < 1.0	
≥ 1.0 < 1.3	
≥ 1.3	
No Peat Recorded At This Location	

Increasing Stability

Scale 1:24000

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

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FIGURE 7-1 : FACTOR OF SAFETY PLAN - SHORT TERM CRITICAL CONDITION (UNDRAINED)

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7.3.2 Drained Analysis for the Peat

The results of the drained analysis for the peat are presented in Appendix F. The results from the main infrastructure locations are summarised in Table 7-4. As stated previously, the drained loading condition examines the effect of in particular, rainfall on the existing stability of the natural peat slopes.

The calculated FoS for load condition (1) for the 332 no. locations analysed, only 10 no. FoS points were less than 1.3 where FoS's of between 1.02 and 1.17 were calculated. In relation to the marginally low FoS's, 6 no. of the FoS points are located alongside existing access roads on site which have been in operation for a number of years and hence are not considered areas at risk of peat instability. However, these areas have an elevated construction risk and are highlighted on the construction buffer zone plan (Figure 4-3).

Areas with marginally low FoS's frequently coincide with steeper slope angles of between 7.6 and 12.1 degrees or localised deeper pockets of peat. It should be noted that the slope angles quoted for these locations are not generally a reflection of the topography at these locations. The slope angles are based on lidar survey data for the area and the steeper slope angles calculated and are likely as a result of localised undulations or variations in vegetation at those particular locations. Applying slope angles reflective of site conditions at these locations in the assessment would result in FoS's greater than 1.3 in these areas.

The remaining 2 no. marginally low FoS's are located along the new proposed access road to turbine T9 and coincides with a deeper pocket of peat. This area has an elevated construction risk and is highlighted on the construction buffer zone plan (Figure 4-3). This location is subject to additional control and mitigation measures as per the adjacent turbine T9 (Appendix E).

The remainder of the locations analysed had acceptable FoS's of greater than 1.3, indicating a low risk of peat instability.

The calculated FoS for load condition (2) is in excess of 1.30 for each of the 332 no. locations analysed with a range of FoS of 1.47 to in excess of 10, indicating a low risk of peat instability.

Table 7-4: Factor of Safety Results (Drained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	583322	823639	3.48	5.17
T2	583831	824112	4.10	6.53
T3	583648	823314	4.10	6.53
T4	584223	823820	1.97	2.08
T5	584259	823347	8.82	10.79
T6	584841	823616	4.78	7.30
T7	584968	823032	7.44	11.88
T8	585523	822935	1.59	2.74
T9	586144	822595	1.69	2.99
T10	584676	822493	3.85	4.14
Substation	584584	823867	9.13	7.39
Temporary Construction Compound 1	584170	823980	2.56	2.74
Temporary Construction Compound 2	585150	823232	2.58	3.13
Met Mast	584059	823136	16.63	13.49

8 PEAT STABILITY RISK ASSESSMENT

A peat stability risk assessment was carried out for the main infrastructure elements at the wind farm. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRA (2017) and MacCulloch (2005).

The risk assessment uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk for each infrastructure element.

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated and rated as shown in Table 8-1. Where a subsection is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', only routine control measures are required.

Table 8-1: Risk Rating Legend

17 to 25	High: avoid works in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

A full methodology for the peat stability risk assessment is given in Appendix G.

8.1 Summary of Risk Assessment Results

The results of the risk assessment for potential peat failure at the main infrastructure elements is presented as a Peat Stability Risk Register in Appendix E and summarised in Table 8-2.

The risk rating for each infrastructure element at the Croagh wind farm is designated negligible and low following some mitigation/control measures being implemented. Sections of access roads to the nearest infrastructure element should be subject to the same mitigation/control measures that apply to the nearest infrastructure element.

Details of the required mitigation/control measures can be found in the Peat Stability Risk Register for each infrastructure element (Appendix E).

Table 8-2: Summary of Peat Stability Risk Register

Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Turbine T1	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T2	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T3	Low	5 to 10	Yes	Low	5 to 10
Turbine T4	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T5	Low	5 to 10	No	Negligible	1 to 4
Turbine T6	Negligible	1 to 4	No	Negligible	1 to 4

Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Turbine T7	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T8	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T9	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T10	Low	5 to 10	No	Low	5 to 10
Met Mast	Negligible	1 to 4	No	Negligible	1 to 4
Substation	Negligible	1 to 4	No	Negligible	1 to 4
Temporary Construction Compound 1	Negligible	1 to 4	No	Negligible	1 to 4
Temporary Construction Compound 2	Negligible	1 to 4	No	Negligible	1 to 4
Construction access road	Low	5 to 10	No	Low	5 to 10

9 COMPARISON OF SITE CONDITIONS WITH KNOWN FAILED SITES

A comparison of conditions at the Croagh site was carried out with sites of known significant failures namely Garvagh Glebe, Derrybrien and Ballincollig Hill. Given the close proximity of the Garvagh Glebe site to Croagh, this comparison is deemed pertinent.

Site and ground conditions at the Croagh site are described as blanket peat on undulating terrain. Peat depths across the site vary based mainly on topography with depths within the proposed infrastructure envelope ranging from 0 to 6m with an average of 2.1m. Undrained shear strengths for the peat recorded using a Geonor H-60 hand-held vane range from 5 to 45kPa with an average of 18kPa.

There is a soft silt/clay deposit immediately underlying the peat on the Croagh site which is typically described as very soft and soft, locally firm, light brown/grey clayey silt. The thickness of the layer varies from 0.3 to 0.6m, locally up to 1m. Undrained shear strength recordings within this layer range from 6 to 50 with an average of 25kPa. Locally a number of relatively higher strength readings (greater than 40kPa) were recorded.

The Garvagh Glebe wind farm site is located to the northeast of the proposed Croagh wind farm site. The failure at Garvagh Glebe occurred in 2008 in a low strength deep peat area at the head of a watercourse/natural drainage route. The failure took place following the construction of a section of access track. Undrained shear strengths of 2 to 4kPa were reported in the failure area along with peat thicknesses of up to 6.3m. Ground conditions comprised blanket peat over a thin soft clay layer with an approximate thickness of 0.2m. The failure occurred within the soft clay layer underlying the peat.

A second, and notably smaller peat failure, occurred at the Garvagh Glebe site whilst constructing an access road along a ridge line in the southwest of the site. This failure occurred on relatively thin peat on steep ground.

With respect to the major failure at Garvagh Glebe the key characteristics are as follows:

(1) Head of a watercourse/natural drainage route
(2) Peat thicknesses of up to 6.3m.
(3) Weak clay below peat
(4) Undrained shear strengths of 2 to 4kPa

As stated above and as per the Garvagh Glebe site there is a soft silt/clay deposit underlying the peat at Croagh. The deposit recorded on the Croagh site, based on descriptions from trial pits, appears similar to the deposit present on the Garvagh Glebe site. It should however be noted that the presence of an underlying soft deposit would be quite common on peatland sites and such sites have been successfully developed in the past.

In summary, in comparison to the location where the major failure occurred on the Garvagh Glebe site, the proposed development footprint at the Croagh site has significantly less likelihood of a similar failure due to:

(1) Head of watercourse/natural drainage routes have been avoided
(2) Reduced peat thicknesses (deeper peat deposits on the Croagh site are located in areas of flat terrain)
(3) Relatively higher strength clay below peat
(4) Higher undrained shear strengths in peat (5 to 45kPa with an average of 18kPa recorded on the Croagh wind farm site)

Peat strength at other sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from essentially back-analysis, though some testing was carried out, was estimated at 2.5kPa. Derrybrien wind farm is located in county Galway and the failure occurred in 2003. The recorded undrained strengths at Croagh are significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Croagh site.

Another peat failure, namely Ballincollig Hill in county Kerry occurred in 2008, and is included here for comparison purposes. In-situ shear strength (undrained) measurements showed high but typically variable peak strength within the upper 1.5m (acrotelm) that varied from about 5 to 40kPa. Within peat below 1.5m

(catotelm) the results show a narrower variation in peak strength that varied between 2.5kPa and about 6kPa. A number of factors were considered to have contributed to the failure namely mechanically cut/harvested peat, high rainfall preceding the failure, weak peat and construction works. The recorded undrained strengths at Croagh are significantly greater than the lower bound values for Ballincollig indicating that there is significantly less likelihood of failure on the Croagh site.

Figure 9-1 shows a comparison of peat strengths with depth recorded at the site compared to sites that have experienced significant failures, as outlined above. The results show that the failed sites have a notably greater proportion of lower recorded strengths, with lower strengths extending to greater depth.

This distribution of recorded strength with depth is illustrated more clearly in Figure 9-2; this shows at failed sites that about 40% of all recorded strengths are less than 10kPa. At the Croagh site approximately 15% of the recorded strengths are below 10kPa.

Whilst the difference between sites may not appear significant in absolute strength terms (the values represent very low soil strengths) the lower bound strengths for the Croagh site are considerably greater than those for the failed sites, which is significant in terms of stability.

For all the cases presented above, construction activities were the common triggering factor for the failures/landslides. The management of peat stability and appropriate construction practices will be inherent in the construction phase of the wind farm to ensure peat failures do not occur on site.

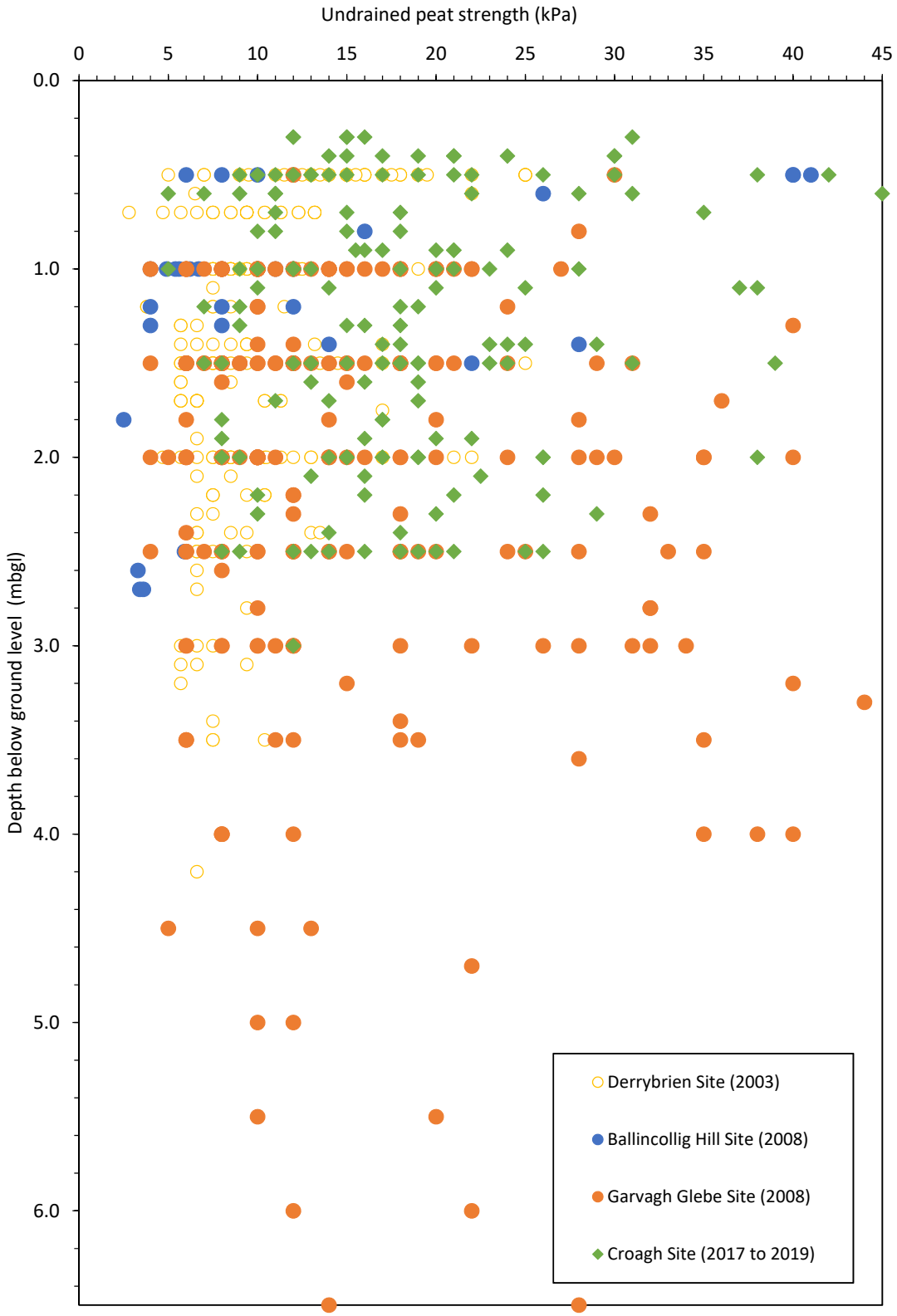


Figure 9-1: Comparison of peat strength (shear vane) with depth from other sites

Notes:
(1) Peat strength measured using a Geonor hand-head shear vane (H60).
(2) Shear strength is unfactored.

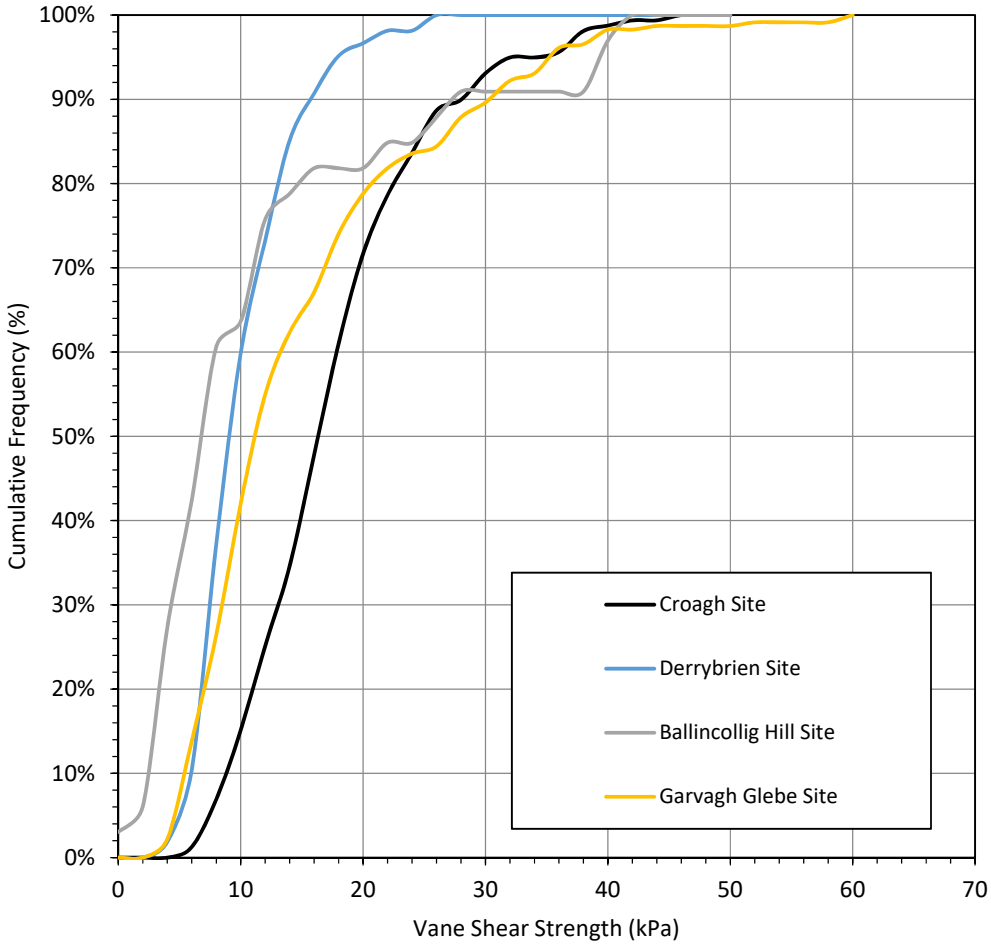


Figure 9-2: Comparison of distribution of peat strength (shear vane) from other sites

Notes:
(1) Peat strength measured using a Geonor hand-head shear vane (H60).
(2) Shear strength is unfactored.

10 IMPLICATIONS OF SOFT DEPOSIT UNDERLYING PEAT

A summary of the main implications for the development of a site with the presence of a soft deposit underlying the peat is given below.

(1) Firstly, it should be noted that the presence of a soft silt/clay layer underlying the peat would be quite common on peatland sites and many such sites have been successfully developed in the past.

(2) A cautious design and construction approach has been adopted for site.

(3) The soft deposit underlying the peat has been taken into account in the geotechnical design of all infrastructure elements.

(4) A ground investigation and subsequent interpretation to confirm the ground conditions predicted in the EIAR, with particular emphasis on peat and underlying soft material stability, will be required prior to the development of the site.

(5) Risk assessments and registers carried out for the site will take the soft deposit underlying the peat into account.

(6) From the ground investigation data, silt is present within the soft material underlying the peat. The strength and deformation behaviour of silt is very susceptible to instability caused by disturbance and the presence of groundwater or surface water.

(7) The use of founded access tracks on competent strata beneath the peat and soft material will be the dominant road construction type on site. The use of floated tracks is limited to areas of flatter terrain on site (i.e. areas less than 5 degrees gradient).

(8) Suitable storage of excavated arisings generated during the construction of the wind farm is pertinent. The side casting and temporary storage of excavated arisings on peat slopes will be limited on site to suitable areas (i.e. flat terrain with competent underlying strata) to avoid triggering instability.

11 INDICATIVE FOUNDATION TYPE FOR TURBINES

Based on a review of the ground investigation information for site, an assessment of the likely foundation type and founding depths for each turbine location was carried out. A summary of this assessment is provided in Table 11-1.

Table 11-1: Summary of Indicative Turbine Foundation Type

Turbine No.	Indicative Turbine Foundation Type	Relevant GI	Ground Conditions
T1	Gravity type foundation	TP24A	Peat to 2.2m overlying firm, locally soft, silt/clay to 2.7m overlying stiff, locally firm, silt/clay
T2	Gravity type foundation	TP1	Peat and soft silt/clay to 1.2m, underlain by firm to very stiff sandy very gravelly Silt/Clay to 3.2m
T3	Possible piled foundation	TP 2A (closest trial pit)	Peat and soft silt/clay to in excess of 4.4m
T4	Gravity type foundation	TP4A (closest trial pit)	Peat and soft silt/clay to 0.8m overlying firm silt/clay to 1.9m overlying stiff silt/clay to 3.1m overlying very stiff silt/clay
T5	Gravity type foundation	TP25A	Peat and soft silt/clay to 1.1m overlying firm, locally stiff, silt/clay to 2.1m overlying very stiff silt/clay
T6	Gravity type foundation	TP26A	Peat and soft silt/clay to 1.9m overlying firm, locally stiff, silt/clay to 2.9m overlying stiff silt/clay
T7	Gravity type foundation	TP12A	Peat and soft silt/clay to 2.8m overlying firm and stiff silt/clay to 3.7m overlying stiff silt/clay
T8	Possible piled foundation	TP14A (closest trial pit)	Peat and soft silt/clay to 2.4m overlying firm, locally stiff, silt/clay
T9	Possible piled foundation	TP16A	Peat to 1.3m overlying firm silt/clay to 1.9m overlying stiff, locally very stiff, silt/clay
T10	Gravity type foundation	TP27A	Peat and very soft and soft silt/clay to 1.2m overlying firm silt/clay to 2.0m overlying stiff silt/clay. Material at base of trial pit recovered as residual soil/extremely weathered shale

It should be noted that confirmatory ground investigation will be carried out at each turbine location in the form of boreholes with in-situ SPT testing at 1 to 1.5m intervals in the overburden and follow-on rotary cores through bedrock to confirm the foundation types outlined in Table 11-1.

For gravity type turbine foundations, where the depth of excavation exceeds the minimum required founding depth for the proposed turbine base, up-fill material consisting of granular fill (6N/6P) in accordance with Transport Infrastructure Ireland (TII) requirements shall be used to backfill the excavation to the required founding depth.

12 FOUNDING DETAILS FOR OTHER INFRASTRUCTURE ELEMENTS

12.1 Access Roads

Up to 11.1km of existing access tracks requiring upgrade are present across the Croagh wind farm site and based on Coillte records have been in operation for a number of years. The existing access tracks were constructed using both excavate and replace and floated construction techniques.

Up to 7.5km of new proposed access roads will be constructed as part of the wind farm construction. The new proposed access roads will be constructed using both excavate and replace and floated construction techniques (see Figure 2-1 of the Peat & Spoil Management Plan). A founded access road will be constructed to provide access the site.

The typical make-up of the new proposed access roads is typically a minimum stone thickness of 1000mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed by confirmatory investigations.

See the Peat & Spoil Management Plan for Croagh wind farm for further details on the existing and new proposed access roads on site.

12.2 Crane Hardstands

The crane hardstands will be constructed using the founded technique (i.e. not floated technique). Crane hardstands are generally constructed using compacted Class 1/6F material in accordance with Transport Infrastructure Ireland (TII) requirements on a suitable sub-formation to achieve the required bearing resistance. The hardstands will be designed for the most critical loading combinations from the crane.

The hardstands will require to be founded on material underlying the peat deposits. The founding levels for the hardstands will be variable across the site and will be confirmed during the pre-construction ground investigations.

The typical make-up of the hardstands would include up to 1000mm of granular stone fill with a layer of geotextile and/or geogrid.

12.3 Substation Foundations & Platforms

The substation platforms will be constructed using the founded technique (i.e. not floated technique). The substation foundations may comprise strip/raft foundations under the main footprint of the building with possibly a basement/pit for cable connections.

Substation platforms are constructed using compacted Class 1/6F material in accordance with Transport Infrastructure Ireland (TII) requirements on a suitable sub-formation to achieve the required bearing resistance. The substation platforms will be founded on material underlying the peat deposits.

Given the ground conditions present at the proposed substation, the foundations will be founded on glacial till. The peat and underlying soft silt/clay are not suitable founding strata for the substation foundations.

The typical make-up of the substation platform may include up to 1000mm of granular stone fill with possibly a layer of geotextile and/or geogrid. At the underside of the substation foundations, a layer of structural up-fill (class 6N/6P) material in accordance with Transport Infrastructure Ireland (TII) requirements will be required.

12.4 Temporary Construction Compound Platforms

The temporary construction compound platforms will be constructed using the founded technique (i.e. not floated technique). The construction compound platforms are generally constructed using compacted Class 1/6F material in accordance with Transport Infrastructure Ireland (TII) requirements on a suitable sub-formation to achieve the required bearing resistance.

The construction compound platforms will require to be founded on competent material underlying the peat deposits.

The typical make-up of the temporary construction compound platform would include up to 1000mm of granular stone fill with a layer of geotextile and/or geogrid.

12.5 Met Mast Foundation

The met mast foundation will comprise gravity type foundation. Given the ground conditions present at the proposed met mast, the foundation will require to be founded on glacial till. The peat and soft silt/clay are not suitable founding strata for the met mast foundation.

Typical founding depth for the met mast foundation is envisaged to be 3.0m. At the underside of the met mast foundation, a layer of structural up-fill (class 6N/6P) material in accordance with Transport Infrastructure Ireland (TII) requirements will likely be required.

12.6 Potential for Development of a Borrow Pit

A number of potential borrow pit locations were reviewed as part of the assessment of the site. A number of trial pits and boreholes were carried out as part of the ground investigation at the site.

A number of the potential borrow pit areas investigated were not progressed further based on ground conditions, in particular the depth to competent rock, or based on the ground profile/topography present.

Ground conditions at the proposed borrow pit location were described as peat to 0.35m overlying very soft and soft clayey Silt to 0.85m overlying firm very gravelly Silt/Clay with occasional cobbles (fragments of shale to 2.2m) overlying weathered shale. Photo 4 of Appendix A shows the shale rock present at a shallow depth at the proposed borrow pit location. The presence of rock at a relatively shallow depth makes this location suitable for development as a borrow pit.

An estimated volume of suitable granular deposits for use during construction was determined from the available ground investigation data and the topographical survey of the area. In addition, it is proposed that the borrow pit will be reinstated using excavated peat and spoil from site.

Further discussion on the proposed borrow pit is provided in the Peat and Spoil Management Plan (FT, 2020) for the site.

12.7 Peat Repository Areas

A number of potential peat repository locations were reviewed as part of the assessment of the site. Two locations were selected and are shown on the site layout plans.

Ground conditions at the repository locations comprise up to 1.5m of peat overlying overburden. Perimeter buttresses required for the repositories will be founded on a competent stratum below the peat deposits. Buttresses will be constructed of well graded granular rock fill.

Further discussion on the peat repositories is provided in the Peat and Spoil Management Plan (FT, 2020) for the site.

12.8 Recreational Infrastructure

A series of walkways/trails are also proposed as part of the development. This includes the construction of car parking area at the northern end of the site. The car park will be constructed of a crushed rock fill placed on a competent stratum. No significant excavations are proposed for the walkways/trails.

13 SUMMARY AND RECOMMENDATIONS

13.1 Summary

The following summary is given.

FT was engaged by McCarthy Keville O'Sullivan to undertake an assessment of the proposed wind farm site with respect to peat stability.

The findings of the geotechnical and peat stability assessment showed that the site generally has an acceptable margin of safety and is suitable for the proposed wind farm development. A number of areas where no development is proposed and areas with an elevated or higher construction risk were identified and are presented in Figure 4-3.

The site is typically covered in blanket peat with undulating terrain. Peat depths vary across the site depending on mainly topography. Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m. Peat depths recorded across the site and outside the proposed infrastructure footprint from over 850 no. peat depth probes ranged from 0 to 8.2m with an average of 2.2m. The deeper peat areas were avoided when optimising the wind farm layout and main infrastructure elements for site.

As part of the geotechnical and peat stability assessment at the site the following activities were undertaken:

- Numerous site walkovers
- Extensive peat depth probing across the site (in excess of 850 no. probes)
- Ground investigation in the form of trial pits and boreholes along with in-situ and laboratory tests
- Desk study including a review of historical landslides in the area
- Inspection of historical landslides within the area
- Assessment of peat stability of upland slopes outside of the Croagh site boundary
- Comparison of ground conditions on the Croagh site with known failed sites

In addition, an analysis of peat sliding was carried out at the main infrastructure locations on site for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The findings of the analyses, which involved analysis of 324 no. locations, showed that the site has an acceptable margin of safety.

For both the undrained and drained condition, all 324 no. locations showed an acceptable FoS of greater than 1.3 except for 10 no. marginally low FoS's. The locations of the marginally low FoS's are highlighted on the construction and buffer zone plan (Figure 4-3) and are typically located alongside existing access roads on site which have been in operation for a number of years and hence are not considered to be areas at risk of peat instability. In addition, 2 no. marginally low FoS's are located along the new proposed access road to turbine T9 and coincide with a deeper pocket of peat. This area has an elevated construction risk and is also highlighted on the construction buffer zone plan (Figure 4-3). This location is subject to additional control and mitigation measures as per the adjacent turbine T9 (Appendix E). The remainder of the locations analysed had acceptable FoS's of greater than 1.3, indicating a low risk of peat instability.

The peat stability risk assessments at each of the main infrastructure locations identified a number of mitigation/control measures to reduce the potential risk of peat failure (see Appendix E).

Whilst there is a high density of historical landslides in the area, no peat failures/landslides are recorded on the Croagh site. A peat slide occurred in 2016 on the surrounding plateau slopes of Croagh to the southwest of the site (outside the site boundary). The likely cause of the peat slide was peat cutting using a 'sausage' machine (mechanically cut peat) in combination with high intensity rainfall. No areas of mechanically cut peat are located within the proposed infrastructure envelope for site.

In relation to the failure which occurred on the Garvagh Glebe site. This failure occurred in a low strength (2 to 4kPa) deep peat (in excess of 6m) area at the head of a watercourse/natural drainage route. Based on data and site findings recorded on the Croagh site, similar site conditions to those recorded at the Garvagh Glebe failure are not present within the proposed infrastructure envelope hence there is a very low likelihood of a similar type failure occurring.

In summary, the findings of the geotechnical and peat stability assessment showed that the proposed Croagh wind farm site has an acceptable margin of safety and is suitable for wind farm development. However, due to the historical landslides in the area around the site, management of peat stability and appropriate

construction practices will be required in the construction phase of the wind farm to ensure peat failures do not occur on site. Overall, the peat characteristics and ground conditions on the Croagh site are similar to those encountered on successfully developed wind farm sites in the area, i.e. sites that were developed without peat instability occurring.

13.2 Recommendations

The following general recommendations are given.

Notwithstanding that the site has an acceptable margin of safety a number of mitigation/control measures are given to ensure that all works adhere to an acceptable standard of safety for work in peatlands. Mitigation/control measures identified for each of the infrastructure elements in the risk assessment shall be taken into account and implemented throughout design and construction works (Appendix E).

Suitable storage of excavated arisings generated during the construction of the wind farm is pertinent. Recommendations and guidelines given in FT's report 'Peat & Spoil Management Plan for Croagh Wind Farm, County Leitrim/Sligo' (FT 2019) will be implemented during the design and construction stage of the wind farm development.

A construction buffer zone plan has been produced for the site (Figure 4-3). This Figure shows areas which have an elevated or higher construction risk due to the terrain and features encountered during the site walkover and are areas where additional mitigation/control measures will be required (Appendix E). In addition, Figure 4-3 shows areas on the site where no development is proposed. The above identified areas are based on qualitative factors identified during the site walkover e.g. relatively deep peat, quaking peat, mechanically cut peat and historical peat landslides in the area.

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMSs) for the project shall take into account, but not be limited, to the recommendations above. This will ensure that best practice guidance regarding the management of peat stability will be inherent in the construction phase.

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Appendix A

Photos from FT/AGEC Site Walkovers











Photo 1 Overview of site conditions



Photo 2 Overview of site conditions



Photo 3 Example of ground profile at an existing excavation on site



Photo 4 Example of shale rock present at proposed borrow pit



Photo 5 Example of ground conditions on site (peat overlying till)



Photo 6 Example of founded access track on site



Photo 7 Example of floated access track on site



Photo 8 Overview of failure in the southwest of the site (looking south) – no development proposed for this area



Photo 9 Overview of failure in the southwest of the site (looking north) – no development proposed for this area



Photo 10 Watercourse crossing along proposed access route to turbine T1

Appendix B

Ground Investigation (2017) – Trial Pit Logs, Laboratory Testing & Photographs






FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 1
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583605.00 824288.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.20		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown fibrous and amorphous Peat
				0.70			Very soft, locally soft, light brown/grey sandy clayey Silt. Shear vane strength recordings of 16, 10, 20 & 22kPa
				1.20			Firm grey sandy Silt/Clay
				1.70			Stiff, locally very stiff, sandy very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles noted as angular, sub-rounded and rounded
				3.20			End of Pit at 3.200m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 2
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583185.00 823794.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m): Depth 2.90		Scale 1:25
Client:	Coillte			Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm and spongy brown fibrous and amorphous Peat
				0.80			Very soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 6, 8, 12, 9 & 20kPa
				1.40			Firm grey slightly sandy gravelly Silt/Clay with occasional cobbles
				2.20			Stiff, locally very stiff, grey slightly sandy very gravelly Silt/ Clay with frequent cobbles. Cobbles noted as angular and sub-rounded
				2.90			End of Pit at 2.900m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 3
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583802.00 823870.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.20		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
	0.30 - 0.70	B	B1	0.30			Firm brown fibrous Peat
				0.70			Soft light grey/brown sandy clayey Silt. Shear vane strength recordings of 30, 28, 32 & 33kPa
				2.10			Firm and stiff grey slightly sandy very gravelly Silt/Clay with occasional cobbles
				3.20			Stiff, locally very stiff grey slightly sandy very gravelly Silt/ Clay with frequent cobbles. Traces of orange mottling noted in layer.
							End of Pit at 3.200m

1
2
3
4

Remarks: No groundwater encountered, small flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 4
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584223.00 823964.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.90		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Firm brown fibrous Peat
				0.60			Soft light grey/brown sandy clayey Silt. Shear vane strength recordings of 32, 36, 30 & 31kPa
				2.60			Firm and stiff sandy gravelly Silt/Clay with occasional cobbles
				3.90			Stiff grey gravelly Silt/Clay with frequent cobbles. Fragments of weathered shale noted in arisings
							End of Pit at 3.900m

1
2
3
4

Remarks: No groundwater encountered, small flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 5
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584872.00 824052.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 2.30		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm & spongy brown fibrous Peat
				0.80			Firm grey sandy clayey Silt. Shear vane strength recordings of 44, 50, 42kPa
				1.60			Stiff grey sandy gravelly Silt/Clay with frequent cobbles. Fragments of weathered shale noted in arisings
				2.30			End of Pit at 2.300m

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Remarks: No groundwater encountered, flow of surface water into excavation noted.
Due to location of trial pit (alongside edge of existing track and close to fence line) difficult to excavate trial pit to a deeper level.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 6
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584772.00 823870.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 2.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			Firm brown fibrous Peat
				1.20			Soft grey sandy clayey Silt. Shear vane strength recordings of 22, 24, 31, 25, 27kPa
				2.10			Firm and stiff sandy gravelly Silt/Clay with frequent cobbles. Fragments of weathered shale noted in arisings. Potential weathered shale rock encountered at 2.1m bgl
							End of Pit at 2.100m

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 7
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584998.00 823376.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.00		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			Firm brown fibrous Peat
				0.80			Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 16, 18, 18, 20, 17kPa
				1.50			Firm grey sandy clayey Silt
				2.20			Firm and stiff grey slightly sandy gravelly Silt/Clay with occasional cobbles
				3.00			Stiff grey very gravelly Silt/Clay with frequent cobbles. Cobbles noted as angular and sub-rounded. Fragments of weathered shale noted in arisings. Boulders noted at 3.0m depth.
							End of Pit at 3.000m

1
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Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 8
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 585240.00 823102.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 4.40		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown fibrous Peat
				0.90			Plastic and spongy /black amorphous Peat
				4.20			Soft grey sandy clayey Silt. No undisturbed lumps of material recovered for shear vane testing
				4.40			End of Pit at 4.400m

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Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 9
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583891.00 823211.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Firm brown fibrous Peat
				0.90			Soft, locally firm, grey sandy clayey Silt. Shear vane strength recordings of 28, 31, 29 & 40kPa
				1.70			Firm, locally stiff, grey sandy gravelly Silt/Clay with occasional cobbles
				3.10			Stiff and very stiff grey slightly sandy gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles noted as angular & sub-rounded and fragments of weathered shale noted in arisings
							End of Pit at 3.100m

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Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 10
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 585419.00 822821.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.40		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown and black fibrous and amorphous Peat
				1.20			Very soft and soft light grey/grey sandy clayey Silt. Shear vane strength recordings of 10, 12, 10, 18, 20, 25 & 19kPa
				1.80			Firm light grey/grey sandy clayey Silt
				3.10			Stiff grey sandy gravelly Silt/Clay with occasional cobbles
				3.40			End of Pit at 3.400m

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 11
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 585661.00 822368.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.20		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown and black fibrous and amorphous Peat
				0.90			Soft to firm light grey/grey sandy clayey Silt. Shear vane strength recordings of 38, 32 & 37kPa
				1.40			Firm light grey/grey sandy clayey Silt.
				1.80			Firm grey sandy gravelly Silt/Clay with occasional cobbles
				3.00			Stiff light brown/grey sandy gravelly Silt/Clay with frequent cobbles
				3.20			End of Pit at 3.200m

1 2 3 4

Remarks: No groundwater encountered, significant flow of surface water into excavation.

Plant Used:

National Materials Testing Laboratory Ltd.

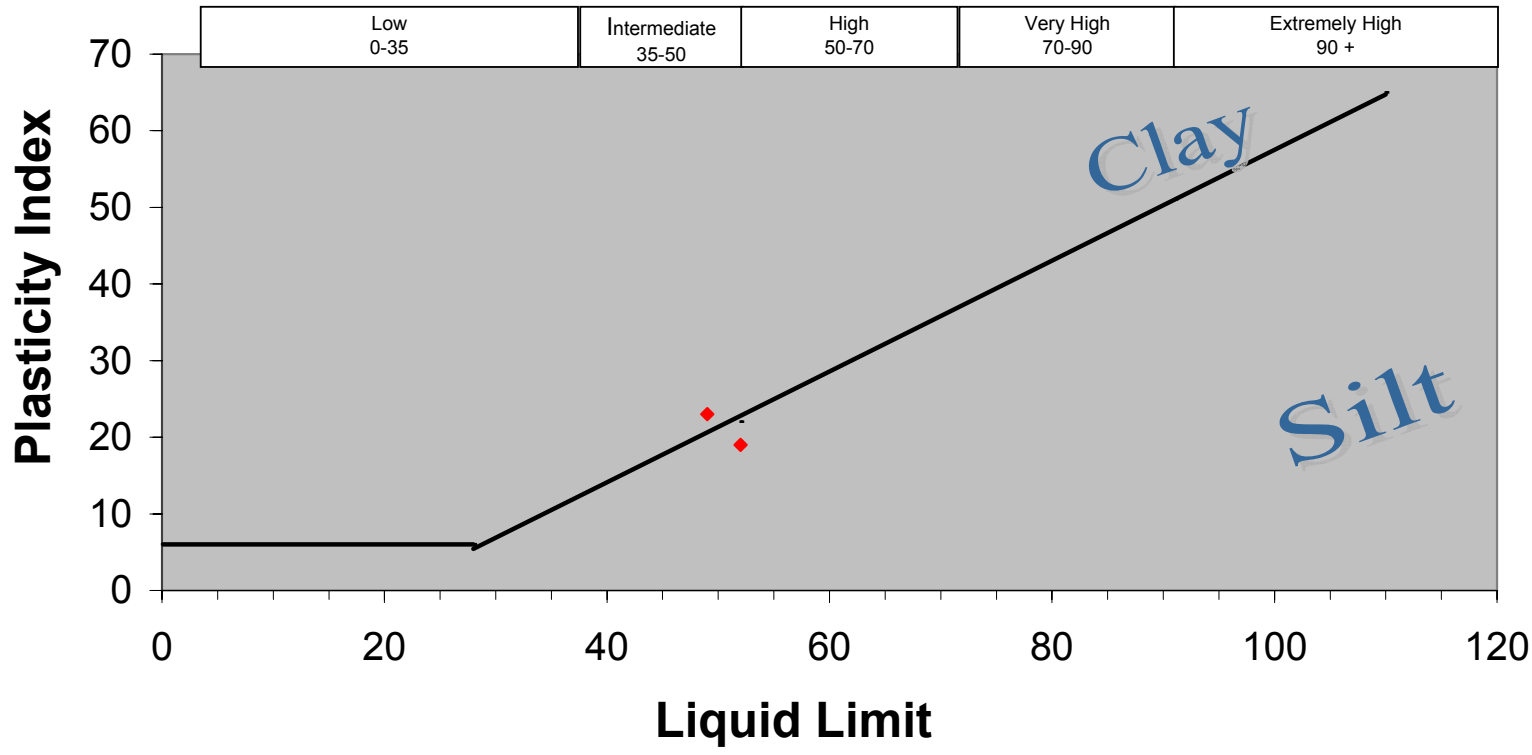
SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
TP3	N/A	B	53.3		76.4	52	33	19						
TP15	N/A	B	31.4		70.2	49	26	23						

NMTL		Notes :									Job ref No.	NMTL 2328		Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.									Location	Carrane Hill, Leitrim		

NMTL LTD
Unit 18c, Tullow Industrial Estate
Tullow
County Carlow
Tel: 00353 59 9180822
Mob: 00353 872575508
billachana@eircom.net

Contract:	**Carrane Hill, Leitrim**
Client:	**AGEC**
Engineer:	**N/A**
Date:	**17/11/2017**
Tested By:	**Tzr** **Checked:** **Bc**
Job ref No.	**NMTL 2328**

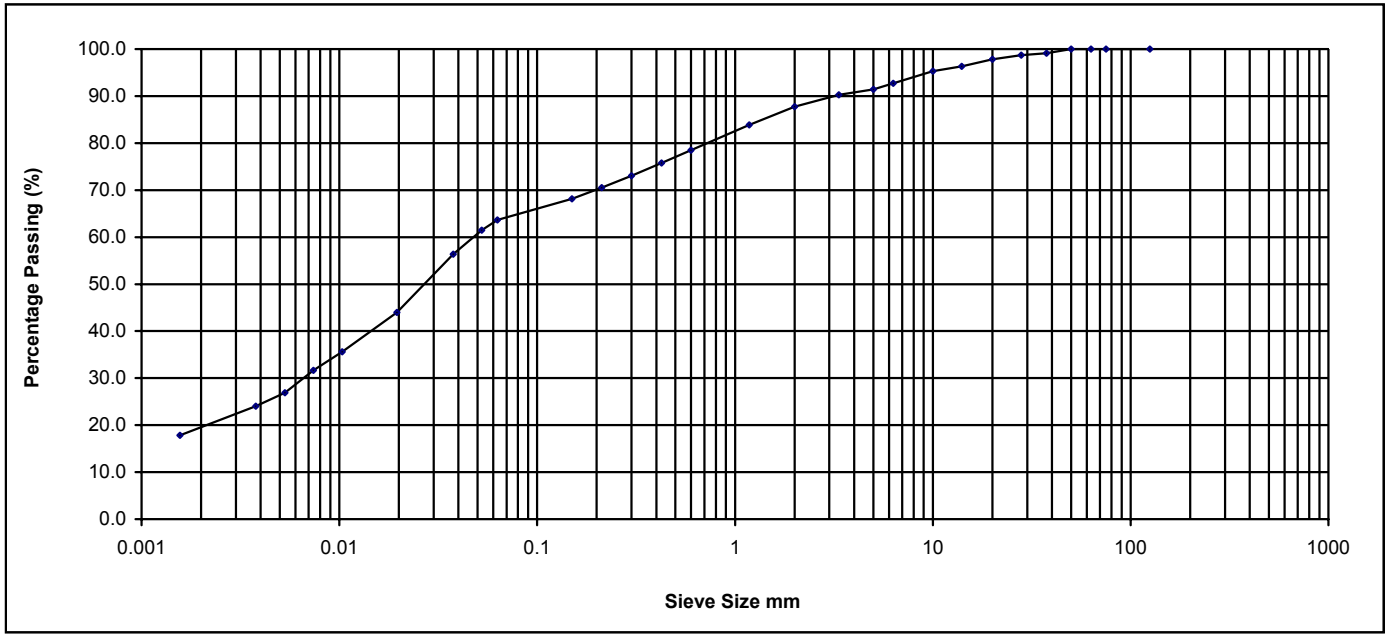


NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	99.1
28.000	98.7
20.000	97.8
14.000	96.3
10.000	95.3
6.300	92.7
5.000	91.4
3.350	90.3
2.000	87.7
1.180	83.8
0.600	78.5
0.425	75.8
0.300	73.0
0.212	70.5
0.150	68.1
0.063	63.6
0.052	61.4
0.038	56.4
0.020	44.0
0.010	35.6
0.007	31.6
0.005	26.9
0.004	24.0
0.002	17.8



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
17.8		45.8			24.1			12.3		0.0	0.0

Sample Description: Dark brown slightly gravelly slightly sandy clayey SILT.

Project: Carrane Hill, Leitrim

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	03/11/2017

Project No.	NMTL 2328
BH/TP No.	TP3
Sample No.	B
Depth	N/A

NMTL Ltd



Photo 1 Trial pit TP1



Photo 2 Trial pit TP2



Photo 3 Underlying soft silt/clay at trial pit TP2



Photo 4 Trial pit TP3



Photo 5 Underlying soft silt/clay at trial pit TP3



Photo 6 Arisings from trial pit TP3



Photo 7 Trial pit TP4



Photo 8 Trial pit TP5



Photo 9 Arisings from trial pit TP6


Photo 10 Trial pit TP6



Photo 11 Arisings from trial pit TP7


Photo 12 Trial pit TP7



Photo 13 Trial pit TP8



Photo 14 Trial pit TP9



Photo 15 Arisings from trial pit TP9


Photo 16 Trial pit TP10



Photo 17 Trial pit TP11

Appendix C

Ground Investigation (2019/20) – Trial Pit Logs, Laboratory Testing & Photographs






FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP1A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583251.00 823685.00 Level: 888.25	Date	01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.20		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy and plastic brown/black pseudo-fibrous and amorphous Peat
				1.10	887.15		Very soft and soft light brown/grey sandy clayey Silt
				1.40	886.85		Firm, locally soft, dark blue/grey slightly sandy gravelly Silt/ Clay with occasional cobbles. Cobbles are sub-rounded and rounded
	2.80 - 3.00	B	B14	2.60	885.65		Stiff dark blue/grey gravelly Silt/Clay with occasional cobbles. Cobbles and boulders are sub-rounded and rounded.
				3.20	885.05		End of Pit at 3.200m

1
2
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4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP2A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583672.00 823360.00 Level: 939.75	Date 01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.40		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.70	939.05		Plastic brown/black pseudo-fibrous and amorphous Peat
				3.50	936.25		Soft, locally firm, blue/grey sandy clayey Silt with occasional cobbles. Cobbles are sub-rounded
	4.00 - 4.20	B	B12				
				4.40	935.35		End of Pit at 4.400m

1
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4

Remarks: Groundwater ingress noted at 3.5m bgl. described as moderate flow

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP3A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583836.00 823526.00 Level: 940.53	Date	01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.80		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	940.23		Spongy brown pseudo-fibrous Peat
				1.10	939.43		Spongy brown amorphous Peat
				1.30	939.23		Soft light brown/grey sandy clayey Silt
				2.10	938.43		Firm brown/grey sandy very gravelly Silt/Clay with frequent cobbles. Cobbles are rounded and angular. Localised angular fragments of shale noted in layer.
				3.80	936.73		Stiff dark blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Localised angular fragments of shale noted in layer. Orange mottling noted in layer.
							End of Pit at 3.800m

1
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Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP4A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584234.00 823711.00 Level: 955.50	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm brown fibrous Peat
				0.50	955.00		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 18, 25, 23 and 31kPa
				0.80	954.70		Firm dark blue/grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular and rounded. Localised angular fragments of shale noted in layer.
				1.90	953.60		Stiff blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded.
	3.20 - 3.50	B	B8	3.10	952.40		Very stiff, locally stiff, blue/grey sandy very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Localised angular fragments of shale noted in layer.
				4.10	951.40		End of Pit at 4.100m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP5A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584229.00 824031.00 Level: 832.09	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown/black pseudo-fibrous Peat
				0.90	831.19		Very soft and soft light brown/grey sandy clayey Silt
	1.90 - 2.10	B	B9	1.30	830.79		Firm, locally soft, dark blue/grey sandy gravelly Silt/Clay with occasional cobbles. Cobbles are angular and rounded. Localised angular fragments of shale noted in layer. Orange mottling noted in layer.
				2.40	829.69		Stiff dark blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Localised angular fragments of shale noted in layer.
				4.10	827.99		End of Pit at 4.100m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP6A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585498.00 823282.00 Level: 1002.19	Date	29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.10		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown fibrous Peat
				0.40	1001.79		Very soft light brown /grey sandy clayey Silt
				0.50	1001.69		Firm and stiff blue/grey sandy gravelly Silt/Clay with occasional cobbles. Cobbles are sub-angular and angular. Localised angular fragments of shale noted in layer
				2.10	1000.09		Stiff blue/grey sandy gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles are sub-rounded and angular, boulders are sub-rounded and rounded. Localised angular fragments of shale noted in layer.
				3.10	999.09		End of Pit at 3.100m

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP7A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583494.00 823756.00 Level: 893.82	Date	01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.50		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm brown/black pseudo-fibrous Peat
				0.50	893.32		Very soft and soft light brown/grey sandy clayey Silt
				0.70	893.12		Firm brown/grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular and sub-rounded. Localised angular fragments of shale noted in layer. Orange mottling/staining noted in layer
				1.70	892.12		Stiff, locally very stiff, blue/grey very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles and boulders are angular and sub-rounded. Cobble and boulder content increases with depth
	2.70 - 2.90	B	B11				
				3.50	890.32		End of Pit at 3.500m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP8A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No.	Coords (E,N):	584858.00 823499.00	Date
		P1989	Level:	976.07	30/04/2019
Location:	County Leitrim/Sligo		Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan		Depth 4.00		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.50	975.57		Plastic brown/black amorphous Peat
				4.00	972.07		End of Pit at 4.000m

1
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Remarks: Groundwater ingress noted at 3.2m bgl, described as moderate flow

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP9A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585085.00 823414.00 Level: 1003.20	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.00		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseduo-fibrous and amorphous Peat
				1.70	1001.50		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 18, 19, 27 and 24kPa
				2.00	1001.20		Firm blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
				2.80	1000.40		Stiff blue/grey slightly sandy very gravelly Silt/Clay with frequent cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
	3.80 - 4.00	B	B5	3.80	999.40		Weathered Shale with a silt/clay matrix
				4.00	999.20		End of Pit at 4.000m

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3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP10A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584076.00 824034.00 Level: 845.53	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm brown/black fibrous Peat
				0.40	845.13		Soft light brown/grey sandy clayey Silt
				0.60	844.93		Firm grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
				1.80	843.73		Stiff, locally firm, blue/grey slightly sandy very gravelly Silt/ Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular. Localised angular fragments of shale noted in layer.
	3.20 - 3.40	B	B10	2.90	842.63		Stiff blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular. Localised angular fragments of shale noted in layer.
				4.10	841.43		End of Pit at 4.100m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP11A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585147.00 823241.00 Level: 967.92	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.50		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous and amorphous Peat
				1.30	966.62		Very soft and soft light brown/grey sandy clayey Silt
				1.50	966.42		Firm blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles. Orange mottling noted in layer. Localised angular fragments of shale noted in layer.
	3.10 - 3.40	B	B4	2.50	965.42		Stiff, locally firm, blue/grey slightly sandy very gravelly Silt/ Clay with frequent cobbles. Orange mottling noted in layer. Cobbles are angular. Localised angular fragments of shale noted in layer.
				3.50	964.42		End of Pit at 3.500m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP12A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584963.00 823032.00 Level: 970.81	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.40		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.90	969.91		Plastic brown amorphous Peat
				2.50	968.31		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 14, 32, 16 and 21kPa
				2.80	968.01		Firm and stiff blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles and boulders are angular and sub-rounded. Localised angular fragments of shale noted in layer.
	4.10 - 4.30	B	B3	3.70	967.11		Stiff blue/grey slightly sandy very gravelly Silt/Clay with frequent cobbles and boulders. Cobbles and boulders are angular and sub-rounded. Localised angular fragments of shale noted in layer.
				4.40	966.41		End of Pit at 4.400m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP13A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584502.00 822527.00 Level: 1042.80	Date 29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 2.80		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.50	1042.30		Spongy brown pseudo-fibrous & amorphous Peat
				2.80	1040.00		Plastic black/brown amorphous Peat End of Pit at 2.800m

1
2
3
4

Remarks: Groundwater ingress noted 2.8m bgl, described as steady flow.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP14A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585478.00 822902.00 Level: 987.96	Date 29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.80		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous & amorphous Peat
				0.80	987.16		Plastic brown/black amorphous Peat
	2.10 - 2.40	B	B1	2.10	985.86		Very soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 12, 13, 16, 15kPa
				2.40	985.56		Firm, locally stiff, blue/grey sandy very gravelly Silt/Clay with occasional cobbles. Orange/light brown mottling noted in layer
				3.80	984.16		End of Pit at 3.800m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP15A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 586587.00 821278.00 Level: 893.65	Date 02/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.90		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm and spongy black/brown fibrous Peat
				1.00	892.65		Soft, locally firm, light brown Clay/Silt with frequent cobbles and boulders. Cobbles and boulders are sub-rounded and rounded
				1.40	892.25		Firm dark blue/grey sandy gravelly Silt/Clay with occasional cobbles. Cobbles are angular.
				3.20	890.45		Stiff dark blue/grey slight sandy gravelly Silt/Clay with frequent cobbles. Cobbles are angular and sub-rounded
				3.90	889.75		End of Pit at 3.900m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP16A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585793.00 822604.00 Level: 1016.21	Date	29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.80		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseduo-fibrous and amorphous Peat
				1.30	1014.91		Firm blue/grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are sub-rounded and angular
				1.90	1014.31		Stiff, locally very stiff, very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles and boulders are sub-rounded and rounded. Boulders vary in size up to 800mm in diameter. Localised angular fragments of shale noted in layer
	3.50 - 3.70	B	B2				
				3.80	1012.41		End of Pit at 3.800m

1 2 3 4

Remarks: Groundwater ingress noted at 1.3m bgl, described as minor ingress.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP17A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584623.00 823207.00 Level: 977.60	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.90		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.70	976.90		Spongy and plastic brown pseudo-fibrous and amorphous Peat
				2.20	975.40		Very soft light brown/grey sandy clayey Silt
				2.30	975.30		Firm blue/dark grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
				3.10	974.50		Stiff blue/dark grey very gravelly Silt/Clay with frequent cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
	3.50 - 3.70	B	B6				
				3.90	973.70		End of Pit at 3.900m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP18A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584564.00 823907.00 Level: 904.18	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.20		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	903.88		Firm brown/black fibrous Peat
				0.60	903.58		Soft light brown/grey sandy clayey Silt
				2.10	902.08		Firm dark blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
	3.90 - 4.10	B	B7	4.20	899.98		Stiff, locally very stiff at depth, dark blue/grey slightly very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles are angular. Localised angular fragments of shale noted in layer.
							End of Pit at 4.200m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP21A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 586026.00 821965.00 Level: 910.98	Date	02/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy and plastic brown pseudo-fibrous and amorphous Peat
				2.90	908.08		Soft light brown/grey sandy clayey Silt
				3.50	907.48		Firm, locally stiff, dark blue/grey slightly sandy gravelly Silt/ Clay with occasional cobbles and boulders. Cobbles and boulders are sub-rounded and rounded
				4.10	906.88		End of Pit at 4.100m

Remarks: Groundwater ingress noted at 2.9m bgl, described as moderate flow

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP22A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584238.00 823501.00 Level: 959.28	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.50		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				1.20	958.08		Plastic brown amorphous Peat
				3.20	956.08		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 17, 14 and 28kPa.
				3.50	955.78		End of Pit at 3.500m

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP23A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583922.00 823194.00 Level: 985.39	Date 01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.90		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown/black pseudo-fibrous Peat
				1.20	984.19		Soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 21, 32 and 27kPa
				1.40	983.99		Firm grey/brown sandy gravelly Silt/Clay with occasional cobbles. Cobbles are rounded. Localised angular fragments of shale noted in layer.
	3.60 - 3.80	B	B13	2.50	982.89		Stiff dark blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Orange mottling noted in layer. Angular fragments of shale noted in layer. Fragments of shale content increases with depth
				3.90	981.49		End of Pit at 3.900m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:
13tN tracked excavator

Irish Drilling Ltd

Croagh Wind Farm, Co. Leitrim **TEST SCHEDULE**

			Soil							Rock	
Trial Pit	**Sample**	**Depth**	**Moisture Content**	**Plastic**	**Liquid**	**Wet**	**Hydrometer**	**Min. Density**	**Max. Density**	**Point Load Strength Tests**	
No	**No.**	**m**		**Limit**	**Limit**	**Sieve**					
TP1A	B14	2.8 - 3.0	1	1	1	1	1				
TP2A	B12	4.0 - 4.2	1	1	1	1	1				
TP3A											
TP4A	B8	3.2 - 3.5	1	1	1	1	1				
TP5A	B9	1.9 - 2.1	1	1	1	1	1				
~~TP6A~~											
TP7A	B11	2.7 - 2.9	1	1	1	1	1				
TP8A											
TP9A	B5	3.8 - 4.0				1	1			1 no. (set of 10)	
TP10A	B10	3.2 - 3.4	1	1	1	1	1				
TP11A	B4	3.1 - 3.3	1	1	1	1	1				
TP12A	B3	4.1 - 4.3	1	1	1	1	1				
TP13A											
TP14A	B1	2.1 - 2.4	1	1	1	1	1				
TP15A											
TP16A	B2	3.5 - 3.7	1	1	1	1	1				
TP17A	B6	3.5 - 3.7	1	1	1	1	1				
TP18A	B7	3.9 - 4.1	1	1	1	1	1	1	1		
~~TP19A~~											
~~TP20A~~											
TP21A											
TP22A											
TP23A	B13	3.6 - 3.8	1	1	1	1	1	1	1		
~~TP24A~~											
TP25A											
		Total	13	13	13	14	14	2	2	1 set	

Summary of Classification Test Results

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
TP01A	14	2.80	3.00	B		Dark grey slightly gravelly slightly sandy clayey SILT.			14.0	60	22	18	4		ML
TP02A	12	4.00	4.20	B		Dark grey slightly gravelly slightly sandy clayey SILT.			34.0	86	32	21	11		CL
TP04A	8	3.20	3.50	B		Dark grey slightly gravelly slightly sandy silty CLAY.			13.0	65	34	19	15		CL
TP05A	9	1.90	2.10	B		Dark grey slightly gravelly slightly sandy silty CLAY.			27.0	62	37	24	13		CI
TP07A	11	2.70	2.90	B		Dark grey slightly gravelly slightly sandy silty CLAY.			9.1	61	29	19	10		CL
TP10A	10	3.20	3.40	B		Dark grey slightly gravelly slightly sandy silty CLAY.			14.0	64	28	21	7		CL
TP11A	4	3.10	3.30	B		Dark grey slightly gravelly slightly sandy silty CLAY.			18.0	84	33	17	16		CL
TP12A	3	4.10	4.30	B		Dark grey slightly gravelly sandy clayey SILT.			21.0	56	25	20	5		ML
TP14A	1	2.10	2.40	B		Dark grey slightly gravelly slightly sandy clayey SILT.			72.0	96	46	29	17		MI
TP16A	2	3.50	3.70	B		Dark grey slightly gravelly slightly sandy silty CLAY.			17.0	60	26	20	6		CL
TP17A	6	3.50	3.70	B		Dark grey slightly sandy slightly gravelly silty CLAY.			28.0	56	31	24	7		ML
TP18A	7	3.90	4.10	B		Dark grey very silty very sandy GRAVEL.			11.0	38	27	18	9		CL
TP23A	13	3.60	3.80	B		Dark grey slightly sandy slightly gravelly silty CLAY.			11.0	53	29	19	10		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

Key

Density test — wd - water displacement; wi - immersion in water

Linear measurement unless : 4pt cone unless : 1pt - single point test; Liquid Limit; NP - Non Plastic

Particle density; sp - small pyknometer; gj - gas jar

Date Printed: 07/02/2019 00:00

QC From No: R1

Approved By:

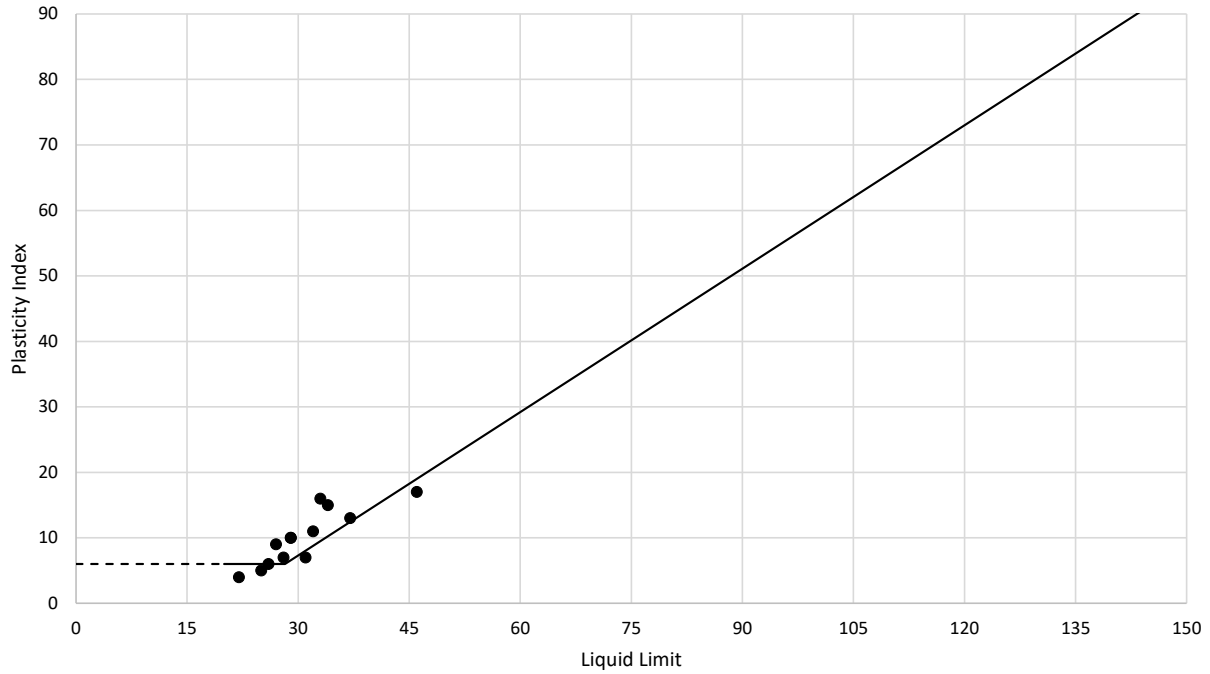
Table 1

sheet 1

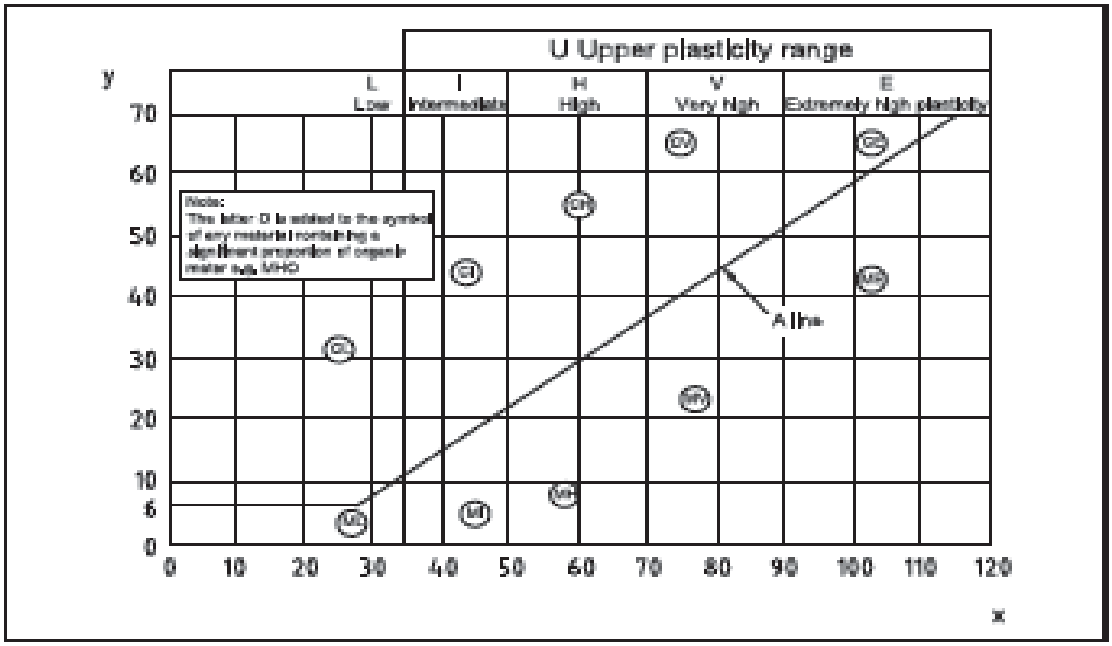
Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Plasticity (A-Line) Chart	Project Number
Project Name:	Croagh Wind Farm, Co. Leitrim	
Location:		2019LM102

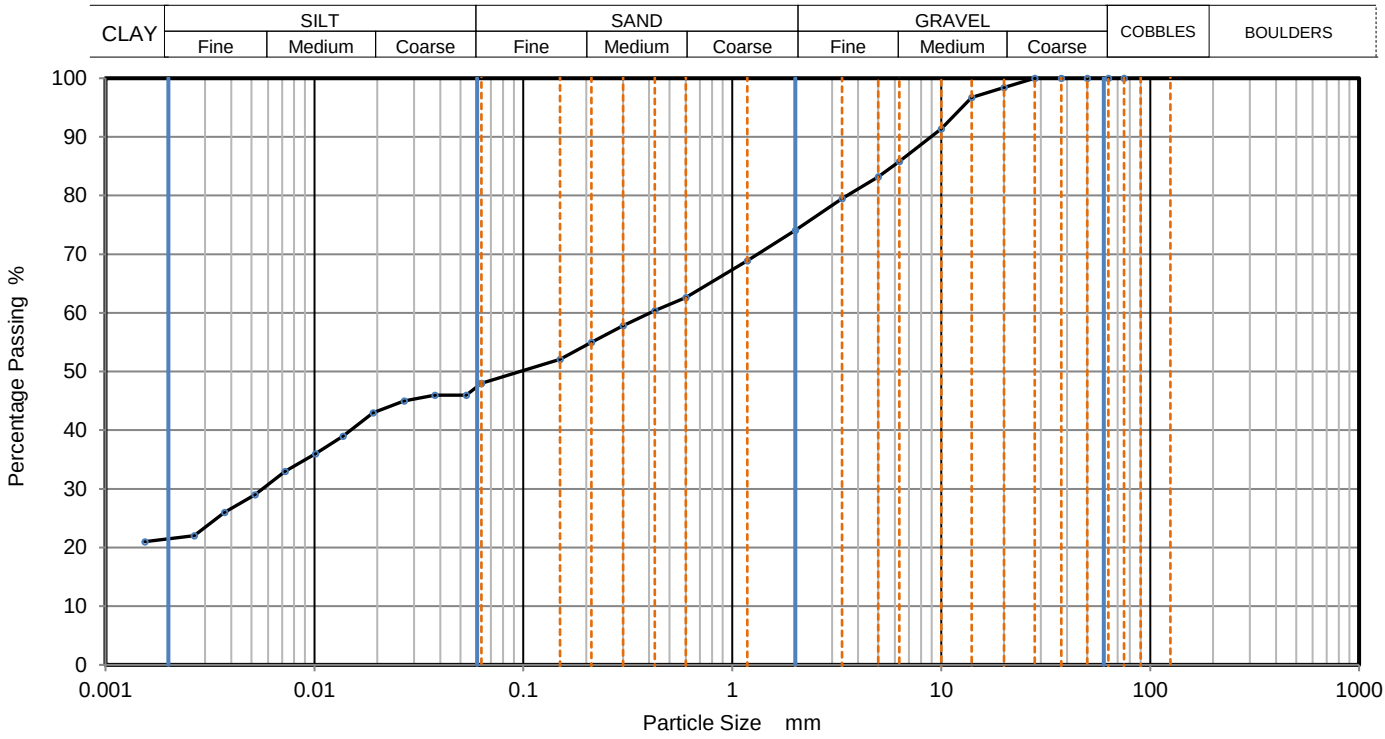


Plasticity chart



QC Form: R1

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP01A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	14
Soil Description	Dark grey slightly gravelly slightly sandy clayey SILT.			Depth, m	2.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP01A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	48
		0.0533	46
75	100	0.0377	46
63	100	0.0268	45
50	100	0.0191	43
37.5	100	0.0137	39
28	100	0.0101	36
20	98	0.0072	33
14	97	0.0052	29
10	91	0.0037	26
6.3	86	0.0027	22
5	83	0.0015	21
3.35	80		
2	74		
1.18	69		
0.6	63	Particle density (assumed)	
0.425	60	2.65 Mg/m3	
0.3	58		
0.212	55		
0.15	52		
0.063	48		

Dry Mass of sample, g	928

Sample Proportions	% dry mass
Very coarse	0
Gravel	26
Sand	26
Silt	27
Clay	21

Grading Analysis		
D100	mm	
D60	mm	0.405
D30	mm	0.00564
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

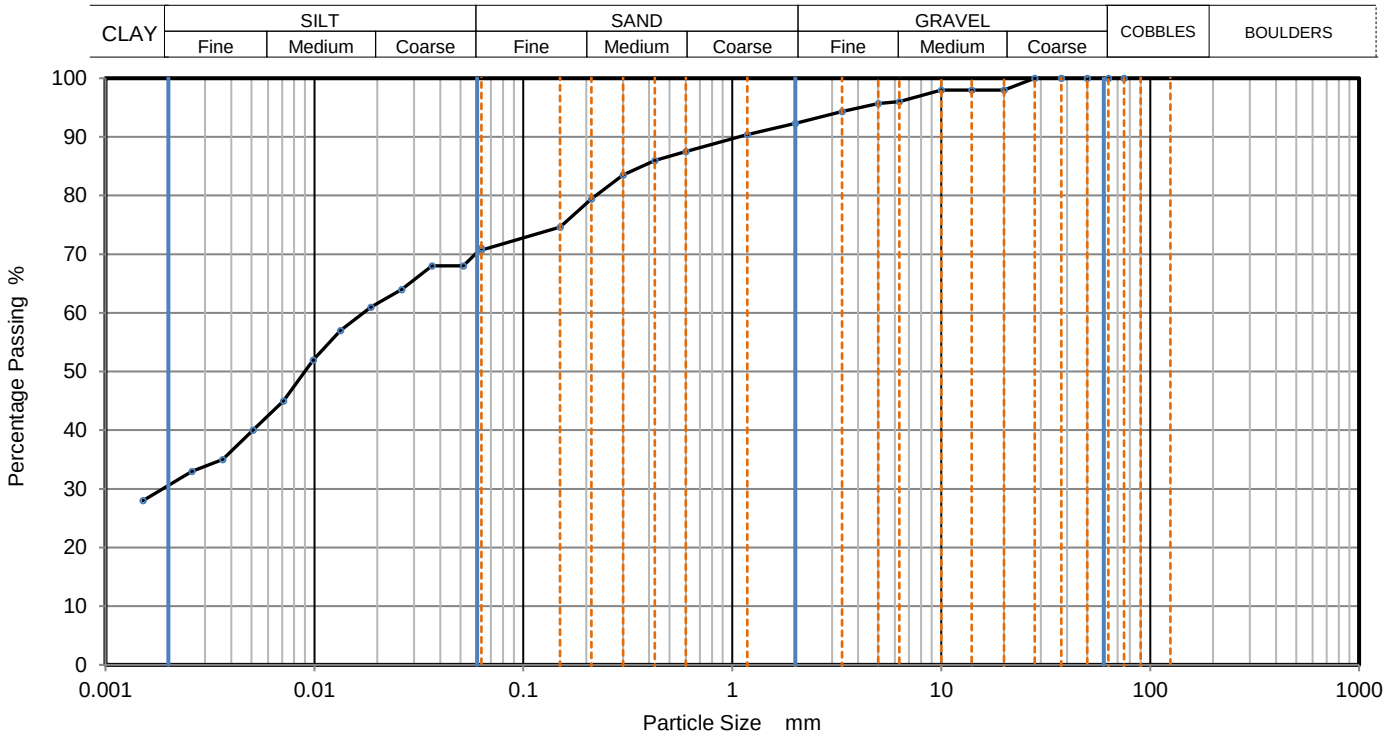
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP02A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	12
Soil Description	Dark grey slightly gravelly slightly sandy clayey SILT.			Depth, m	4.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP02A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	71
		0.0516	68
75	100	0.0365	68
63	100	0.0262	64
50	100	0.0186	61
37.5	100	0.0133	57
28	100	0.0099	52
20	98	0.0071	45
14	98	0.0051	40
10	98	0.0036	35
6.3	96	0.0026	33
5	96	0.0015	28
3.35	94		
2	92		
1.18	90		
0.6	88	Particle density (assumed)	
0.425	86	2.65 Mg/m3	
0.3	84		
0.212	79		
0.15	75		
0.063	71		

Dry Mass of sample, g	679

Sample Proportions	% dry mass
Very coarse	0
Gravel	8
Sand	22
Silt	40
Clay	31

Grading Analysis		
D100	mm	
D60	mm	0.017
D30	mm	0.00184
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

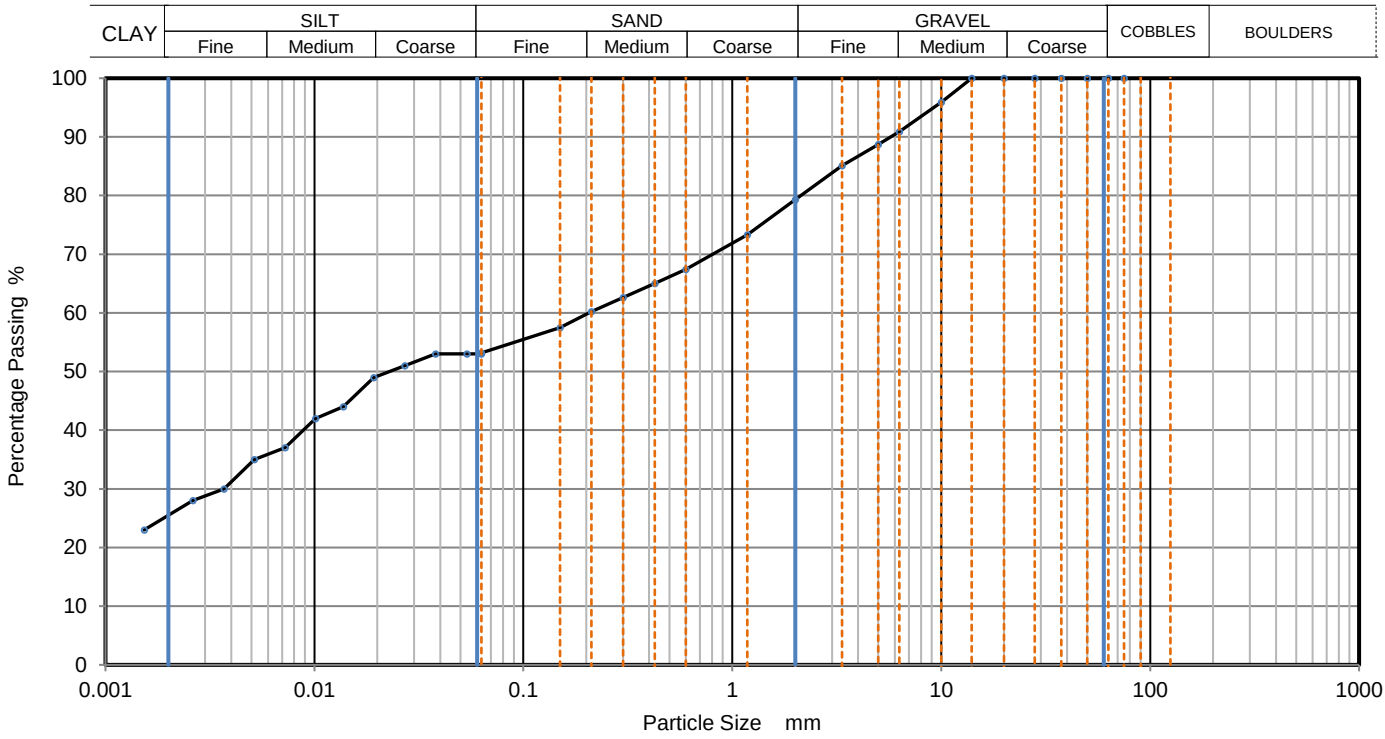
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP04A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	8
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP04A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	53
		0.0537	53
75	100	0.0380	53
63	100	0.0270	51
50	100	0.0192	49
37.5	100	0.0138	44
28	100	0.0101	42
20	100	0.0072	37
14	100	0.0052	35
10	96	0.0037	30
6.3	91	0.0026	28
5	89	0.0015	23
3.35	85		
2	79		
1.18	73		
0.6	67	Particle density (assumed)	
0.425	65	2.65 Mg/m3	
0.3	63		
0.212	60		
0.15	58		
0.063	53		

Dry Mass of sample, g	981

Sample Proportions	% dry mass
Very coarse	0
Gravel	21
Sand	26
Silt	28
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.207
D30	mm	0.00365
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

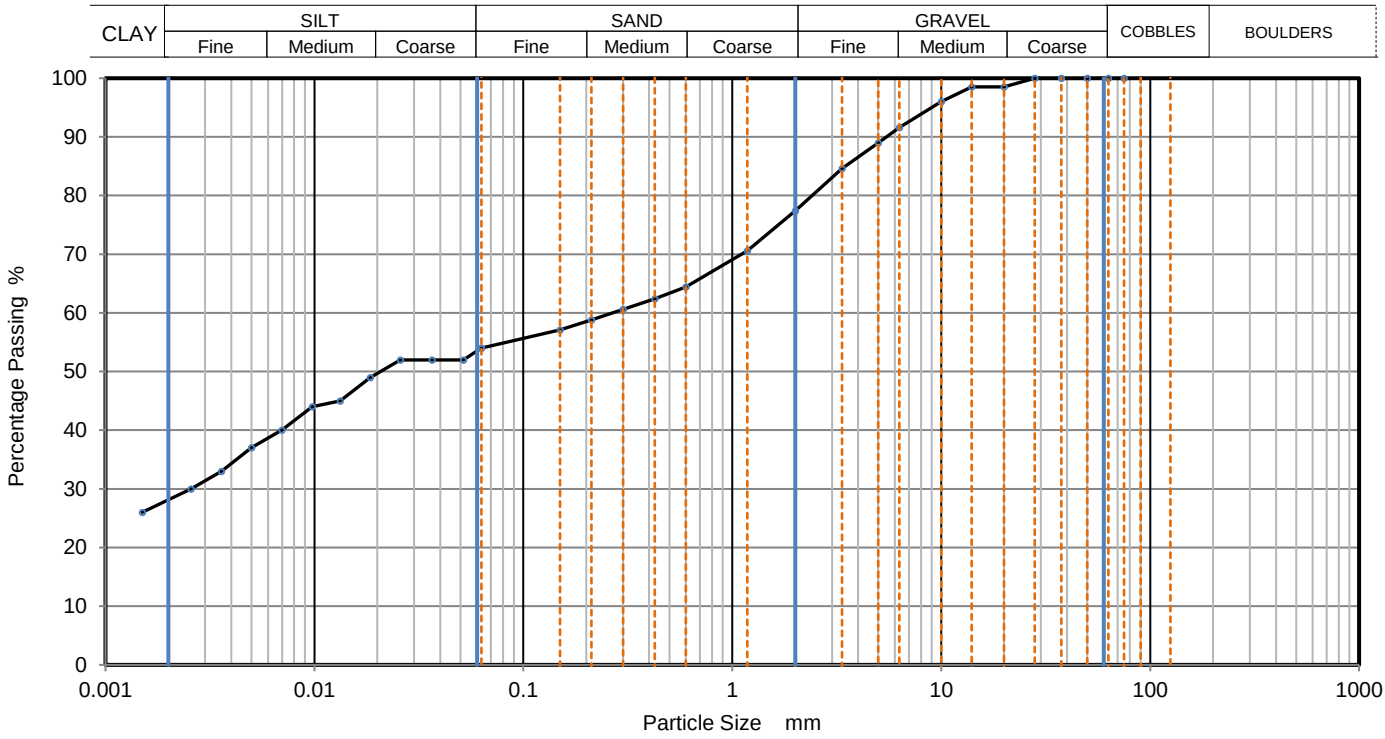
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP05A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	9
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	1.90
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP05A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	54
		0.0516	52
75	100	0.0365	52
63	100	0.0258	52
50	100	0.0185	49
37.5	100	0.0133	45
28	100	0.0098	44
20	99	0.0070	40
14	99	0.0050	37
10	96	0.0036	33
6.3	92	0.0026	30
5	89	0.0015	26
3.35	85		
2	77		
1.18	71		
0.6	64	Particle density (assumed)	
0.425	62	2.65 Mg/m3	
0.3	61		
0.212	59		
0.15	57		
0.063	54		

Dry Mass of sample, g	742

Sample Proportions	% dry mass
Very coarse	0
Gravel	23
Sand	23
Silt	26
Clay	28

Grading Analysis		
D100	mm	
D60	mm	0.267
D30	mm	0.00266
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

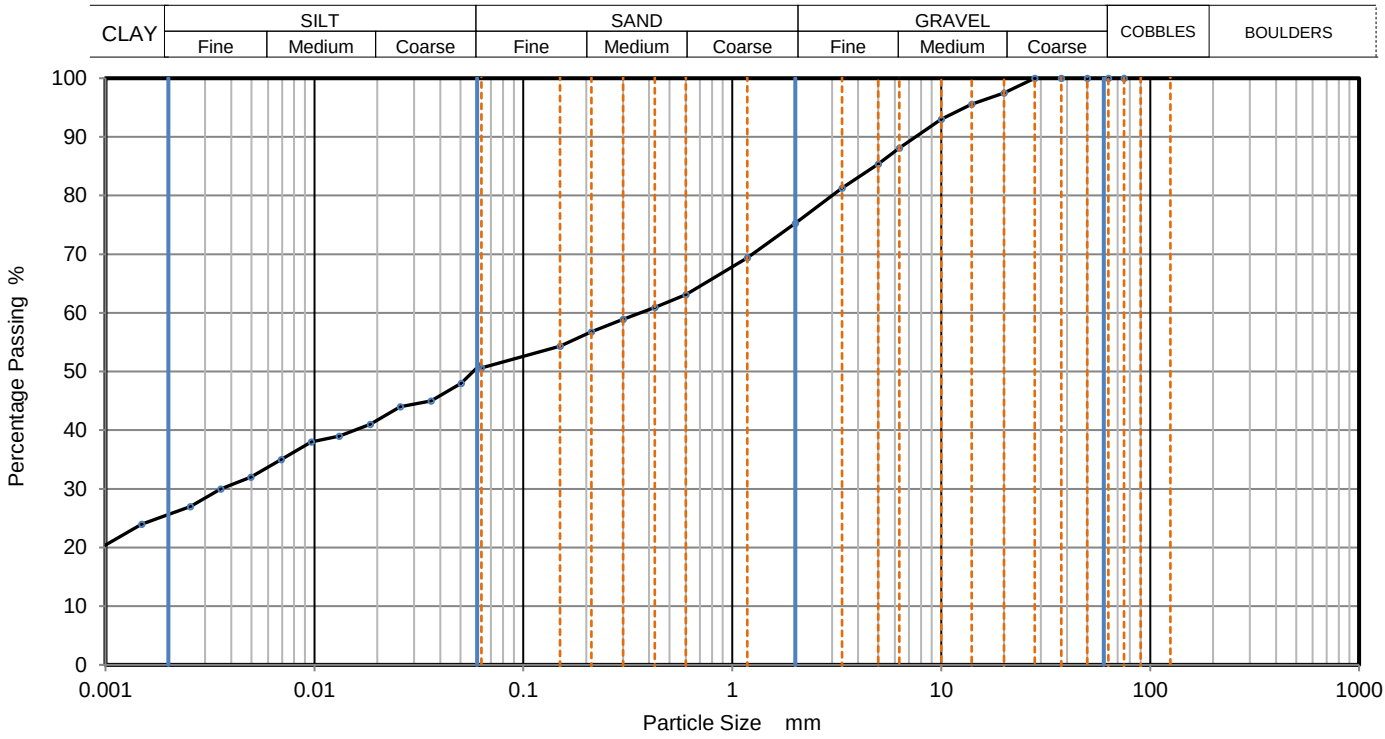
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP07A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	11
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	2.70
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP07A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0614	51
		0.0504	48
75	100	0.0362	45
63	100	0.0258	44
50	100	0.0185	41
37.5	100	0.0132	39
28	100	0.0097	38
20	98	0.0069	35
14	96	0.0050	32
10	93	0.0036	30
6.3	88	0.0025	27
5	85	0.0015	24
3.35	81	0.0008	18
2	75		
1.18	69		
0.6	63	Particle density	(assumed)
0.425	61	2.65	Mg/m3
0.3	59		
0.212	57		
0.15	54		
0.063	51		

Dry Mass of sample, g	833

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	25
Silt	25
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.364
D30	mm	0.00377
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

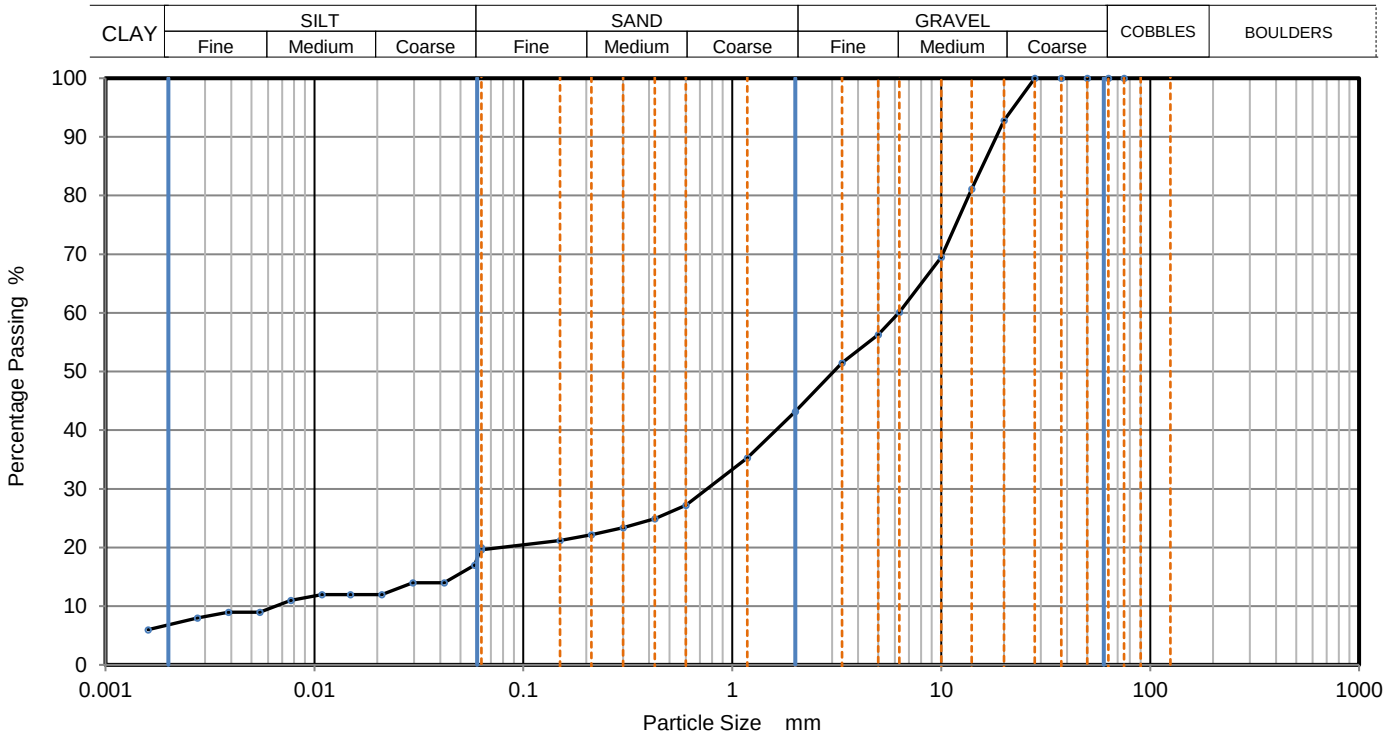
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP09A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	5
Soil Description	Dark grey very silty very sandy medium GRAVEL.			Depth, m	3.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP09A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	20
		0.0585	17
75	100	0.0418	14
63	100	0.0296	14
50	100	0.0210	12
37.5	100	0.0149	12
28	100	0.0109	12
20	93	0.0077	11
14	81	0.0055	9
10	70	0.0039	9
6.3	60	0.0028	8
5	56	0.0016	6
3.35	52		
2	43		
1.18	35		
0.6	27	Particle density (assumed)	
0.425	25	2.65	Mg/m3
0.3	23		
0.212	22		
0.15	21		
0.063	20		

Dry Mass of sample, g	827

Sample Proportions	% dry mass
Very coarse	0
Gravel	57
Sand	24
Silt	13
Clay	7

Grading Analysis		
D100	mm	
D60	mm	6.26
D30	mm	0.757
D10	mm	0.00681
Uniformity Coefficient		920
Curvature Coefficient		13

Remarks

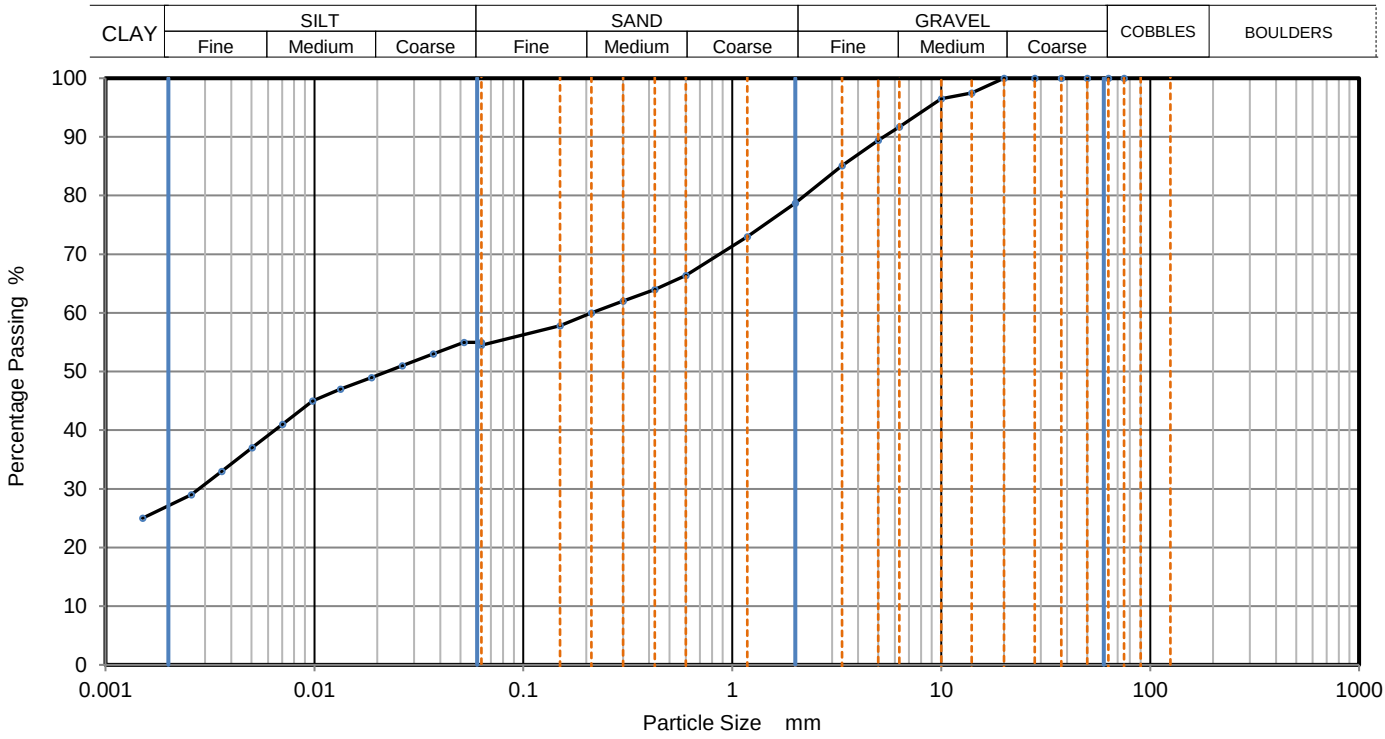
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP10A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	10
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP10A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	55
		0.0520	55
75	100	0.0370	53
63	100	0.0263	51
50	100	0.0187	49
37.5	100	0.0133	47
28	100	0.0098	45
20	100	0.0070	41
14	98	0.0050	37
10	97	0.0036	33
6.3	92	0.0026	29
5	89	0.0015	25
3.35	85		
2	79		
1.18	73		
0.6	66	Particle density (assumed)	
0.425	64	2.65 Mg/m3	
0.3	62		
0.212	60		
0.15	58		
0.063	55		

Dry Mass of sample, g	789

Sample Proportions	% dry mass
Very coarse	0
Gravel	21
Sand	24
Silt	27
Clay	27

Grading Analysis		
D100	mm	
D60	mm	
D30	mm	0.00276
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

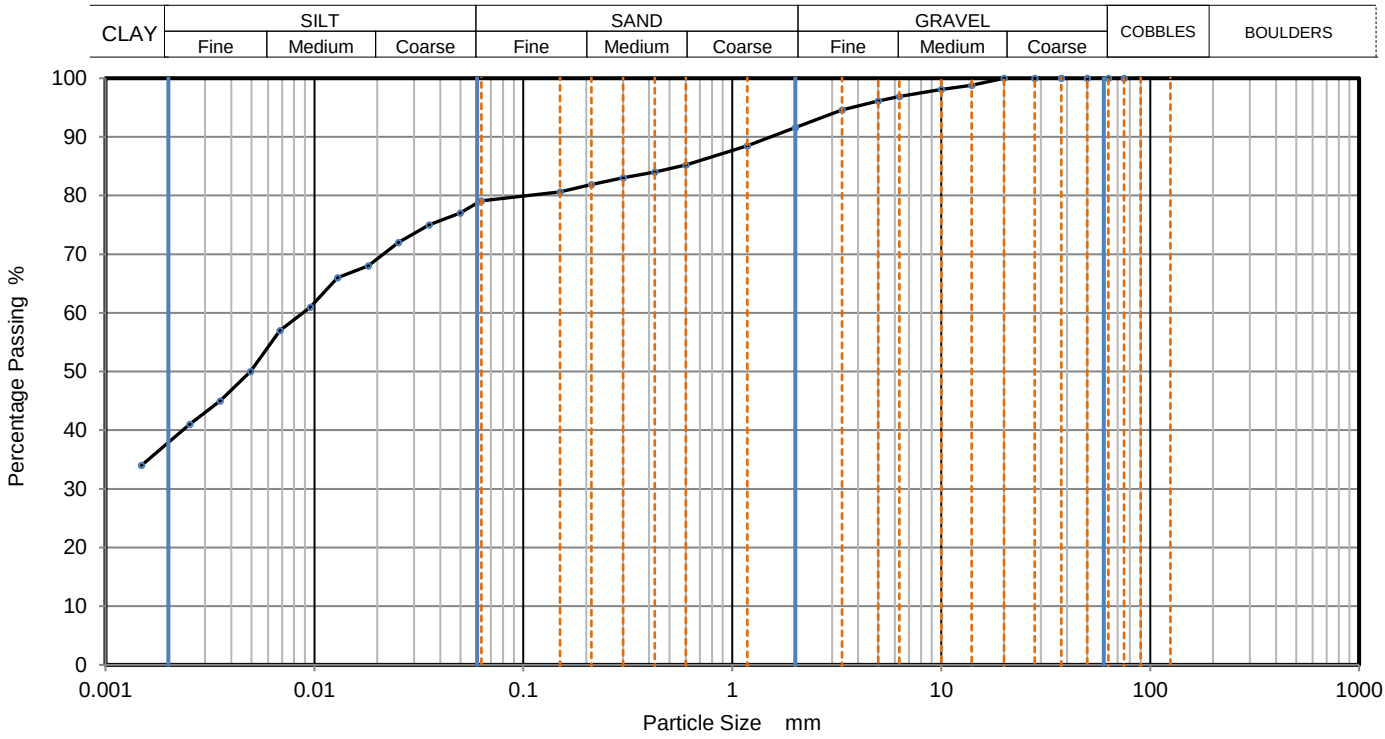
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP11A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	4
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP11A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0618	79
		0.0498	77
75	100	0.0355	75
63	100	0.0253	72
50	100	0.0181	68
37.5	100	0.0129	66
28	100	0.0096	61
20	100	0.0068	57
14	99	0.0049	50
10	98	0.0035	45
6.3	97	0.0025	41
5	96	0.0015	34
3.35	95		
2	92		
1.18	89		
0.6	85	Particle density (assumed)	
0.425	84	2.65 Mg/m3	
0.3	83		
0.212	82		
0.15	81		
0.063	79		

Dry Mass of sample, g	913

Sample Proportions	% dry mass
Very coarse	0
Gravel	8
Sand	13
Silt	41
Clay	38

Grading Analysis		
D100	mm	
D60	mm	0.00886
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

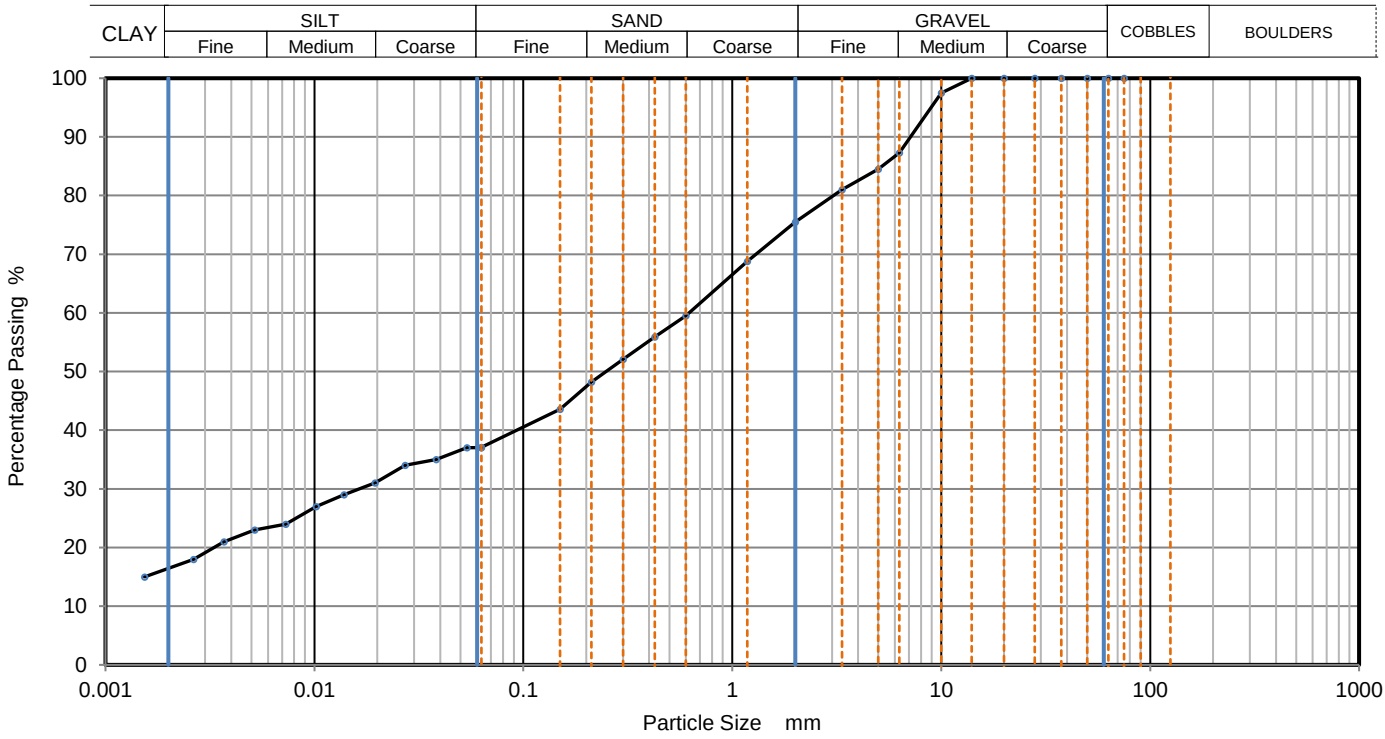
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP12A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	3
Soil Description	Dark grey slightly gravelly sandy clayey SILT.			Depth, m	4.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP12A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	37
		0.0537	37
75	100	0.0382	35
63	100	0.0272	34
50	100	0.0195	31
37.5	100	0.0139	29
28	100	0.0102	27
20	100	0.0073	24
14	100	0.0052	23
10	98	0.0037	21
6.3	87	0.0026	18
5	85	0.0015	15
3.35	81		
2	76		
1.18	69		
0.6	60	Particle density (assumed)	
0.425	56	2.65	Mg/m3
0.3	52		
0.212	48		
0.15	44		
0.063	37		

Dry Mass of sample, g	616

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	38
Silt	21
Clay	16

Grading Analysis		
D100	mm	
D60	mm	0.62
D30	mm	0.017
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

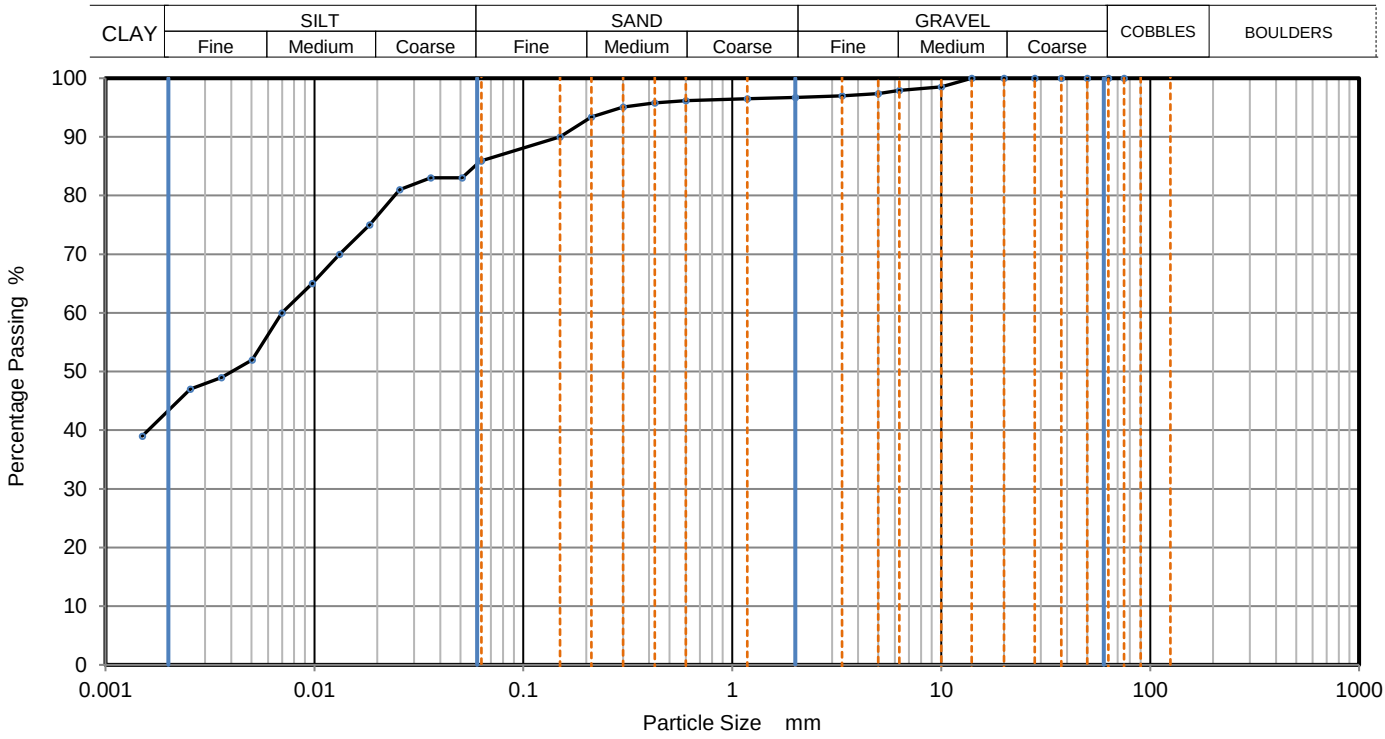
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP14A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	1
Soil Description	Dark grey slightly gravelly slightly sandy clayey SILT.			Depth, m	2.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP14A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0628	86
		0.0509	83
75	100	0.0360	83
63	100	0.0256	81
50	100	0.0184	75
37.5	100	0.0132	70
28	100	0.0098	65
20	100	0.0070	60
14	100	0.0050	52
10	99	0.0036	49
6.3	98	0.0025	47
5	97	0.0015	39
3.35	97		
2	97		
1.18	97		
0.6	96	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	93		
0.15	90		
0.063	86		

Dry Mass of sample, g	328

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	11
Silt	43
Clay	43

Grading Analysis		
D100	mm	
D60	mm	0.00705
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

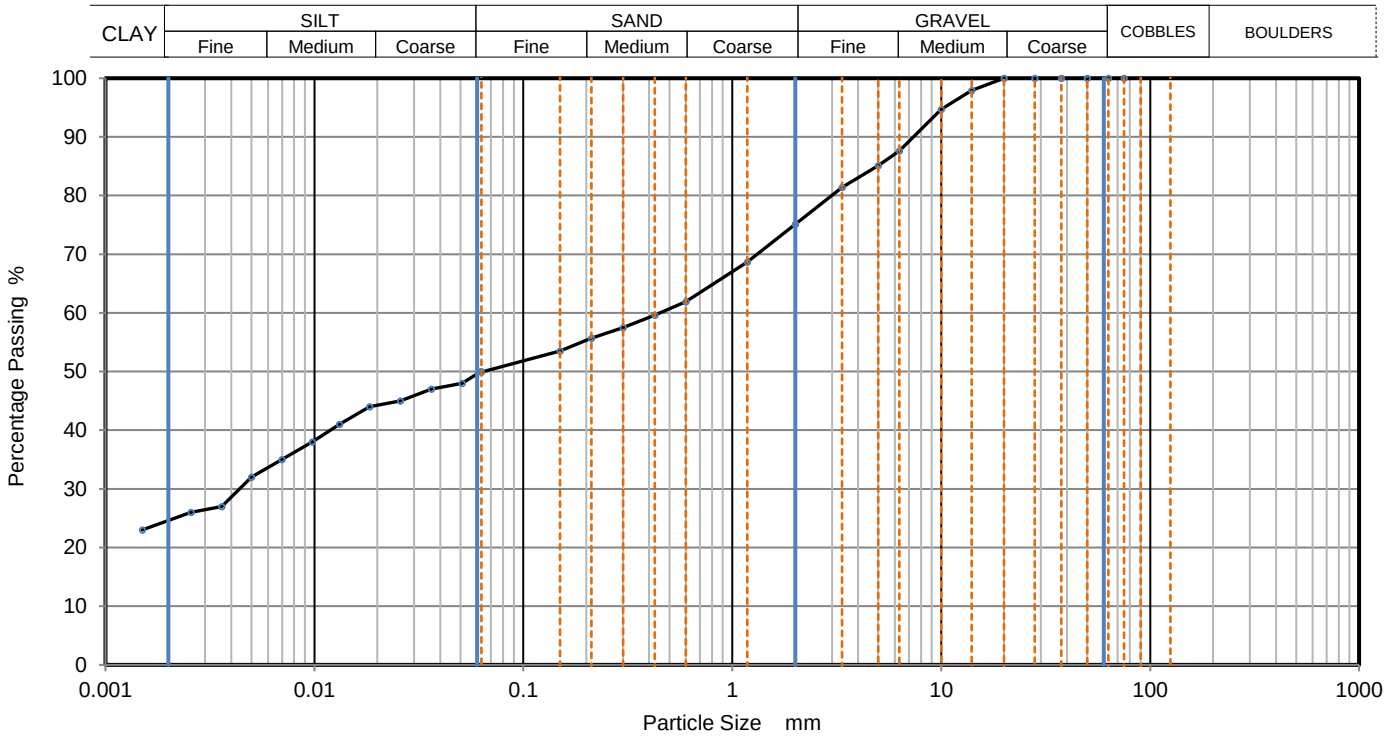
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IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP16A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	2
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP16A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0628	50
		0.0509	48
75	100	0.0362	47
63	100	0.0258	45
50	100	0.0184	44
37.5	100	0.0132	41
28	100	0.0098	38
20	100	0.0070	35
14	98	0.0050	32
10	95	0.0036	27
6.3	88	0.0026	26
5	85	0.0015	23
3.35	81		
2	75		
1.18	69		
0.6	62	Particle density (assumed)	
0.425	60	2.65	Mg/m3
0.3	58		
0.212	56		
0.15	54		
0.063	50		

Dry Mass of sample, g	1007

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	25
Silt	26
Clay	24

Grading Analysis		
D100	mm	
D60	mm	0.453
D30	mm	0.00441
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

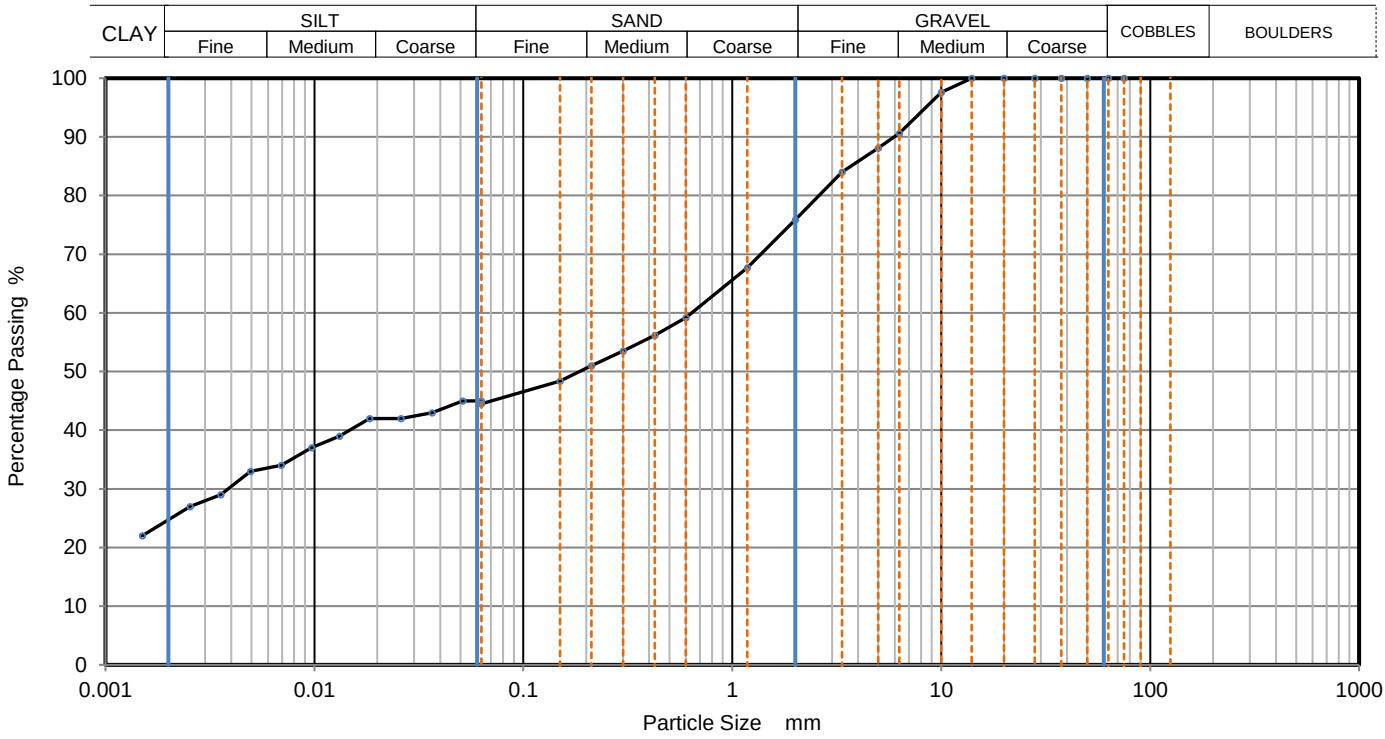
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Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP17A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	6
Soil Description	Dark grey slightly sandy slightly gravelly silty CLAY.			Depth, m	3.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP17A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	45
		0.0513	45
75	100	0.0365	43
63	100	0.0260	42
50	100	0.0184	42
37.5	100	0.0132	39
28	100	0.0097	37
20	100	0.0069	34
14	100	0.0049	33
10	98	0.0036	29
6.3	91	0.0025	27
5	88	0.0015	22
3.35	84		
2	76		
1.18	68		
0.6	59	Particle density (assumed)	
0.425	56	2.65	Mg/m3
0.3	54		
0.212	51		
0.15	48		
0.063	45		

Dry Mass of sample, g	13284

Sample Proportions	% dry mass
Very coarse	0
Gravel	24
Sand	31
Silt	20
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.641
D30	mm	0.00393
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

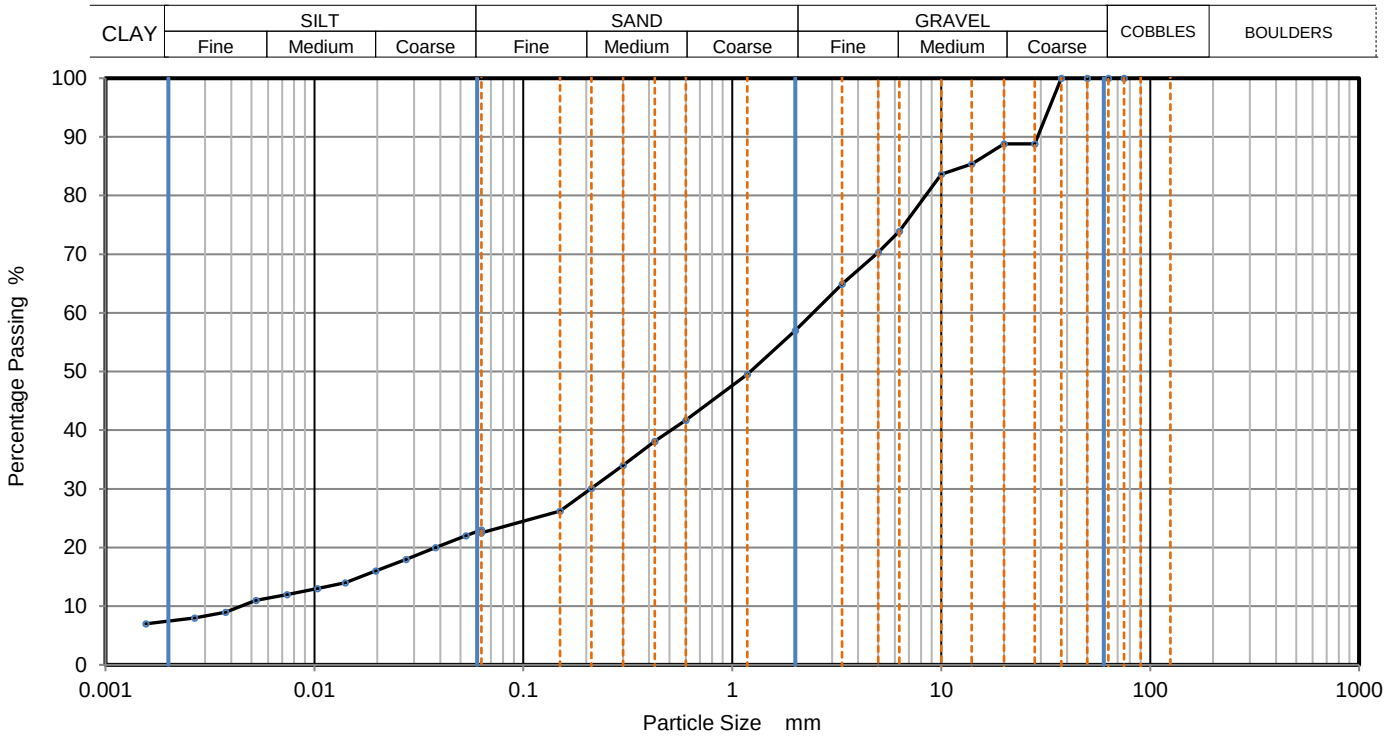
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP18A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	7
Soil Description	Dark grey very silty very sandy GRAVEL.			Depth, m	3.90
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP18A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	23
		0.0531	22
75	100	0.0380	20
63	100	0.0274	18
50	100	0.0196	16
37.5	100	0.0140	14
28	89	0.0103	13
20	89	0.0074	12
14	85	0.0053	11
10	84	0.0038	9
6.3	74	0.0027	8
5	70	0.0016	7
3.35	65		
2	57		
1.18	50		
0.6	42	Particle density (assumed)	
0.425	38	2.65 Mg/m3	
0.3	34		
0.212	30		
0.15	26		
0.063	23		

Dry Mass of sample, g	803

Sample Proportions	% dry mass
Very coarse	0
Gravel	43
Sand	35
Silt	15
Clay	7

Grading Analysis		
D100	mm	
D60	mm	2.43
D30	mm	0.211
D10	mm	0.00444
Uniformity Coefficient		550
Curvature Coefficient		4.1

Remarks

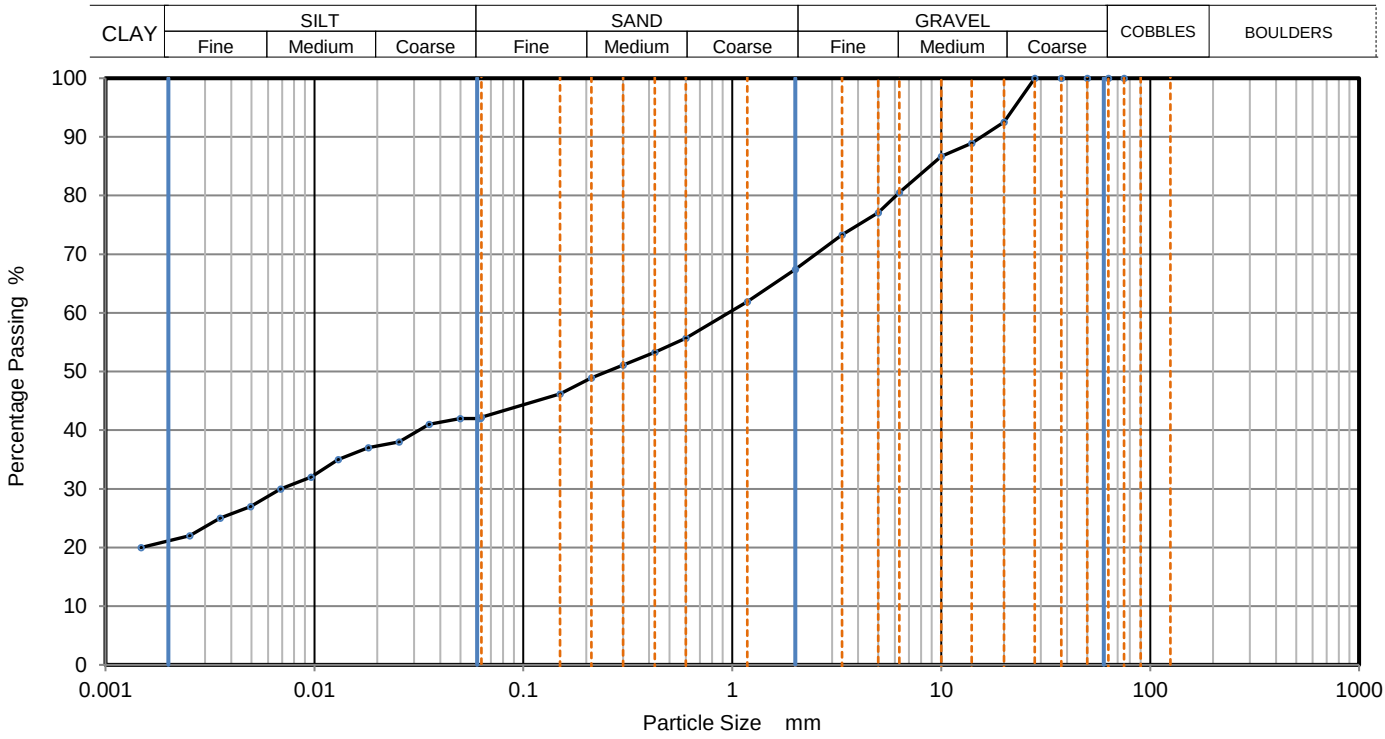
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP23A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	13
Soil Description	Dark grey slightly sandy slightly gravelly silty CLAY.			Depth, m	3.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP23A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0623	42
		0.0498	42
75	100	0.0355	41
63	100	0.0254	38
50	100	0.0181	37
37.5	100	0.0130	35
28	100	0.0096	32
20	93	0.0069	30
14	89	0.0049	27
10	87	0.0035	25
6.3	81	0.0025	22
5	77	0.0015	20
3.35	73		
2	67		
1.18	62		
0.6	56	Particle density (assumed)	
0.425	53	2.65 Mg/m3	
0.3	51		
0.212	49		
0.15	46		
0.063	42		

Dry Mass of sample, g	871

Sample Proportions	% dry mass
Very coarse	0
Gravel	33
Sand	25
Silt	21
Clay	21

Grading Analysis		
D100	mm	
D60	mm	0.961
D30	mm	0.00709
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

Summary of Results for Maximum and Minimum Dry Density Tests

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Hole No.	Sample				Soil Description	Test Method	Oversize material (as appropriate)			Dry density		Remarks
	Ref	Top	Base	Type			>37.5mm %	>6.3mm %	>2mm %	Maximum Mg/m3	Minimum Mg/m3	
TP18A	7	3.90	4.10	B	Dark grey very silty very sandy GRAVEL.	4.3, 4.5				2.02	1.35	
TP23A	13	3.60	3.80	B	Dark grey slightly sandy slightly gravelly silty CLAY.	4.3, 4.5				1.99	1.18	

Notes

Tests performed in accordance with BS 1377 : Part 4 : 1990
and clauses : 4.2, 4.4 sandy soil
4.3, 4.5 gravelly soil

Date Printed: 07/02/2019 00:00

Approved By:

Table 1

sheet 1



Photo 1 Trial pit TP1A



Photo 2 Trial pit TP2A



Photo 3 Trial pit TP3A



Photo 4 Trial Pit 4A



Photo 5 Arisings from trial pit TP4A



Photo 6 Trial pit TP5A



Photo 7 Trial pit TP6A



Photo 8 Arisings from trial pit TP6A



Photo 9 Trial pit TP7A



Photo 10 Trial pit TP9A



Photo 11 Arisings from trial pit TP9A


Photo 12 Trial pit TP10A



Photo 13 Trial pit TP11A



Photo 14 Trial pit TP12A



Photo 15 Trial pit TP13A



Photo 16 Trial pit TP14A



Photo 17 Trial pit TP15A



Photo 18 Trial pit TP16A



Photo 19 Trial pit TP17A



Photo 20 Trial pit TP18A



Photo 21 Trial pit TP17A



Photo 22 Trial pit TP18A



Photo 23 Trial pit TP22A



Photo 24 Trial pit TP23A

RECORD OF TRIAL PIT TP01_MKO

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TP01_MKO **Trial Pit Location: N E**

Date: 13 September 2019 **Logged by:** MW (MKO)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.30	Soft brown PEAT		
0.30	0.85	Grey sandy clayey Silt		
0.85	2.9	Firm blue/grey slightly sandy very gravelly Silt/Clay		
2.9	3.4	Weathered shale in a silt/clay matrix		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.



TP01_MKO

RECORD OF TRIAL PIT TP03_MKO

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TP03_MKO **Trial Pit Location: N E**

Date: 13 September 2019 **Logged by:** MW (MKO)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.35	Soft brown PEAT		
0.35	0.85	Very soft to soft light brown/grey sandy clayey Silt		
0.85	2.2	Firm blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles		
2.2	3.3	Weathered shale in a silt/clay matrix		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.



TP03_MKO

RECORD OF TRIAL PIT TPAR1

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR1 **Trial Pit Location: E** 587701 **N** 823093

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	1.30	Made Ground – clayey gravel (shale)		
1.30	2.20	Firm brown fibrous PEAT		
2.20	4.10	Stiff dark blue/grey SILT/CLAY		
4.1		End of trial pit		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR2

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR2 **Trial Pit Location: E** 588267 **N** 823162

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.60	Peaty topsoil		
0.60	1.50	Firm brown slightly gravelly CLAY		
1.50	3.20	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
4.1		End of trial pit		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR3

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR3 **Trial Pit Location: E** 588807 **N** 822991

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.25	Topsoil		
0.25	0.80	Firm brown slightly gravelly CLAY		
0.80	4.10	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
4.1		End of trial pit		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR4

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR4 **Trial Pit Location: E** 589127 **N** 822863

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.20	Topsoil		
0.20	0.70	Firm brown slightly gravelly CLAY		
0.70	2.50	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
2.50		End of trial pit (Boulder)		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR5

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR5 **Trial Pit Location: E** 590217 **N** 823253

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.20	Topsoil		
0.20	0.70	Firm brown slightly gravelly CLAY		
0.70	2.20	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
2.20		End of trial pit (Boulder)		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR6

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR6 **Trial Pit Location: E** 589504 **N** 822084

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.20	Topsoil		
0.20	0.80	Firm brown slightly gravelly CLAY		
0.70	2.50	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
2.50		End of trial pit (Boulder)		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

Appendix D

Ground Investigation (2019) – Borehole Logs, Laboratory Testing & Photographs






IRISH DRILLING LIMITED

LOUGHREA, CO. GALWAY, IRELAND

CONTRACT DRILLING
SITE INVESTIGATION

Phone: (091) 841 274
Fax: (091) 847 687

email: info@irishdrilling.ie

CROAGH WIND FARM

SITE INVESTIGATION CONTRACT FACTUAL REPORT

MKO,
Tuam Road,
Galway.

Fehily Timoney & Company,
Consulting Engineers,
Singleton's Lane,
Bagenalstown,
Carlow.

	Prepared by	Approved by	Rev. Issue Date:	Revision No.
	Ronan Killeen	Declan Joyce	16th August 2019	19 _LM_102/001
Signature				

FOREWORD

The borehole records have been compiled from an examination of the samples by a Geotechnical Engineer and from the Drillers' descriptions.

The report presents an opinion on the configuration of the strata within the site based on the borehole results. The assumptions, though reasonable, are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

Contents:

1.0	Introduction
2.0	The Site & Geology
3.0	Fieldwork
4.0	Laboratory Testing

Book 1 of 1

Appendix 1	Borehole Records (Rotary Core)
Appendix 2	Permeability Test Records
Appendix 3	Groundwater Readings
Appendix 4	Laboratory Test Results
Appendix 5	Laboratory Test Results (Trial Pits)
Appendix 6	Photographs (Rotary Core)
Appendix 7	AGS Data
Appendix 8	Site Plan

1.0 Introduction.

Irish Drilling Ltd. (IDL) was instructed by Fehiliy Timoney & Partners, Consulting Engineers, on behalf of KMO, to carry out a site investigation at the site of the proposed Croagh Wind Farm Project.

This site investigation was carried out to provide detailed factual geotechnical information of the underlying ground conditions at the location of the proposed works.

The fieldwork commenced on May 29th 2019 and was completed on June 25th 2019.

2.0 Site & Geology

The site is located within lands currently owned by Coillte, close to the boundary of County Sligo and County Leitrim.

Geological Survey of Ireland Maps for the region indicate that the site is underlain by the Carboniferous Limestone and Siltstone Rock Formations.

The fieldwork was carried out predominantly on accessible existing tracks within densely forested woodlands.

A Site Plan, prepared by the client's representatives to show approximate 'as-built' locations, is included with this report.

3.0 Fieldwork.

The following plant was mobilised to site to carry out fieldwork operations:

GT1100 GoTract Rotary Core Drilling Rig.

Fieldwork carried out to date has included the following:

Four rotary core boreholes were carried out to establish overburden conditions and rockhead and to establish the nature and integrity of the underlying rock.

Wireline drilling techniques, using HQ size drill strings, were carried out to recover soil and rock core samples. The core samples recovered consisted of the following core diameters: 64mm (HQ).

The samples were stored in wooden boxes and returned to the laboratory where there were logged and photographed by a Geotechnical Engineer and presented for testing.

The rotary core boreholes were carried out to depths ranging from 30.20m to 30.30m below ground level.

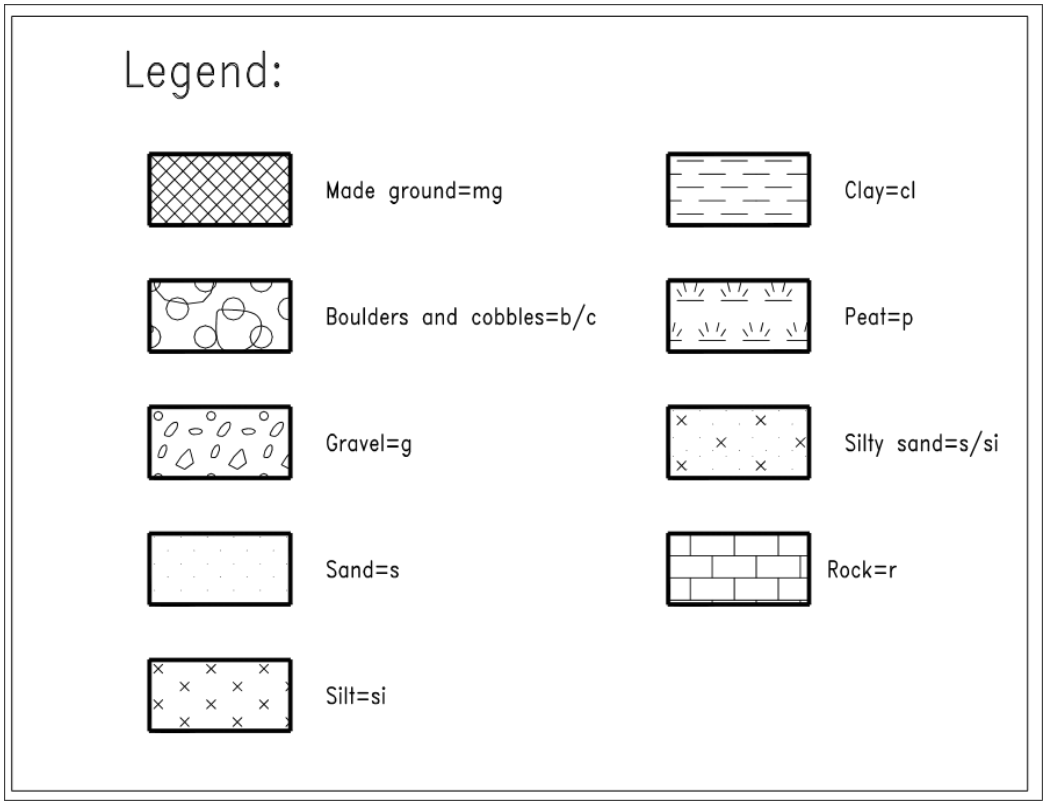
In–Situ testing consisting of Standard Penetration Tests were carried out in the overburden at regular intervals (predominantly 1.0m intervals) or as instructed by the client's representatives.

A 50mm diameter standpipe was installed in all the boreholes and as instructed by the Client's Engineer, to allow for monitoring of groundwater levels over a prolonged period of time.

In-Situ tests consisting of Rising and/or Falling Head Permeability Tests were carried out in the boreholes and the records of same are included as appendix 2 of this factual report.

Bedding planes are defined as the surface that separates one stratum, layer or bed stratified rock from another. Discontinuity is defined as the plane of physical weakness where the tensile strength perpendicular to the discontinuity or the shear strength along the discontinuity is lower than that of the surrounding soil or rock material.

The following Key Legend Table details the symbology used on the engineering logs to describe ground conditions encountered:



Ground conditions encountered during the completion of the fieldwork were typical and as expected for this region and predominantly consisted of Glacial Tills overlying bedrock.

The Glacial Tills (where recovered) in general consisted of slightly sandy gravelly silty clay with cobbles and boulders.

Dark green brown silt was also recovered in borehole BH 02 at a depth of 4.20m to 4.80m below ground level.

Possible weathered bedrock was encountered in borehole BH 03 at a depth of 10.70m to 14.90m below ground level and in borehole BH 04 at a depth of 6.20m to 9.80m below ground level.

Intact bedrock was also encountered in all of the rotary core boreholes at depths ranging from 4.80m to 17.40m below ground level.

For detailed descriptions of bedrock please refer to the engineering logs included in the appendices to this report.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

Where possible the borehole locations were set out on site using a Trimble CU Bluetooth GPS Surveying Unit and the co-ordinates are included on the logs presented in the appendices.

All fieldwork co-ordinates are reported to Irish Transverse Mercator (ITM) with Reduced Levels recorded relative to Malin Head Datum and with an accuracy level of + or – 0.10m. Co-ordinates for borehole BH 04 may be compromised due to the presence of dense forestation which may have affected the use of the Bluetooth GPS Surveying Unit.

4.0 Laboratory Testing

Representative samples recovered from the boreholes were scheduled for testing in the laboratory. The test schedules were prepared by the Client's Engineer and included some or all of the following tests on rock core samples:

* Point Load.
* UCS Test.
* Slake Durability.
* Magnesium Sulphate Soundness.
* LAA.

The records of these laboratory tests are included as Appendix 4 of this factual report.

The soil and rock descriptions as noted on the borehole logs are in general visual descriptions as observed and logged by our Engineers and are described in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations.

Soils descriptions (cohesive or otherwise) are also initially assessed based on the texture and 'feel' of the soil materials as witnessed by our Geotechnical Engineers and in accordance with IS EN 1997-2 and BS5930.

Where laboratory classification tests have been carried out on soil or rock samples then these visual descriptions have been amended accordingly to take into account the results of these classification tests.

Representative samples recovered from trial pits that were carried out on site by others (and on behalf of the client) were also scheduled for testing in the laboratory.

The test schedules were prepared by the Client's Engineer and included some or all of the following tests on disturbed soil samples:

* Natural Moisture Content.
* Atterberg Limits.
* Particle Size Distribution.
* Sedimentation.
* Density.
* Point Load (Set of 10).

The records of these laboratory tests carried out on trial pit soil samples are included as Appendix 5 of this factual report.

The records of all fieldwork, laboratory test results and photographs are included in the appendices of this Factual Report.

Ronan Killeen
Chartered Engineer
Irish Drilling Limited
August 16th 2019

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	11-06-19 13-06-19	296.99	E 583,929.8 N 823,187.2

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
11-06 0.00						0.00 - 17.40 : overburden.	Open hole drilling - no recovery.		
1.50	0 (-) -	(5) NA			(4.20)				
3.00		(30/30mm)							
4.20			292.79		4.20				
11-06 4.60	50 (-) -						Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles and boulders. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone. Core run - 4.60m to 5.10m: 1 No light brown sandstone boulder 390mm in length. Core run - 5.10m to 6.10m: 1 No light brown sandstone boulder 290mm in length.		
11-06 5.10	80 (-) -								
11-06 5.10	20 (-) -	(15/30mm)							
6.10									
11-06	29 (-) -								
7.80									
11-06 7.80	29 (-) -	(20/30mm)							
9.20									
11-06 9.60	100 (-) -								
11-06 9.60	100 (-) -	(50/0mm)							
10.80									
11-06		NA			(13.20)				

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
11-06-19	17.00	10.80	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	30.30	water	100

GENERAL REMARKS

50mm standpipe installed. Response zone from 13.60m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

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old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	11-06-19 13-06-19	296.99	E 583,929.8 N 823,187.2

Engineer: Fehily Timoney & Co

Sheet 2 of 3

Rev. REV 1

RUN DETAILS						STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
12.20	50 (-) -							Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles and boulders. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone. *(continued)* Core run - 12.20m to 13.80m: 1 No light brown sandstone boulder 560mm in length.		
11-06 13.80	88 (-) -									
11-06 15.20	100 (-) -									
11-06 16.80	69 (-) -									
11-06 18.20	100 (39) 14	3 NI	279.59		17.40	17.40 - 30.30 Discontinuities, closely spaced, locally very closely spaced, locally medium spaced, dipping 8 to 10°, planar, smooth, with 0.5 to 3mm thick dark grey silt smear. 17.60 - 18.00 Non-intact as weathered rock. 18.80 - 19.10 Joint, subvertical dip, planar, smooth, with 0.5 to 2mm thick dark grey silt smear, open. 20.30 - 20.50 Joint, subvertical dip, planar, smooth, with 0.5 to 2mm thick dark grey silt smear and minor surficial finely disseminated pyrite, open. 21.80 - 22.10 2 No parallel joints,		Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE.		
11-06 19.60	100 (94) 35	15 18								
11-06 21.20	100 (84) 35	28								
11-06	100	20								

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

50mm standpipe installed. Response zone from 13.60m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	11-06-19 13-06-19	296.99	E 583,929.8 N 823,187.2

Engineer	Sheet	Rev.
Fehily Timoney & Co	3 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
22.80	(97) 32	25				subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear and minor finely disseminated pyrite, open.	Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. *(continued)*		
11-06 24.40	100 (93) 51	10			(12.90)	22.20 - 22.75 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.	22.45m to 22.47m: cubic pyrite.		
		11				23.50 - 23.65 Joint, vertical dip, undulating, rough, with 0.5mm thick dark grey silt smear and minor surficial finely disseminated pyrite, open.	24.10m to 24.15m: light grey silt.		
11-06 25.60	100 (96) 74	13				25.00 - 25.20 Joint, subvertical dip, undulating, tight.			
11-06 27.20	100 (95) 50	11				26.45 - 26.70 Joint, vertical dip, undulating, rough, with 0.5mm thick grey silt smear and minor orange brown iron stain, open.			
11-06 28.80	100 (86) 36	20 16				28.00 - 28.50 Joint, vertical dip, undulating, smooth, with 0.5 to 3mm thick grey silt smear, open to moderately wide.	27.85m to 27.90m: light grey silt.		
11-06 30.30	100 (91) 47	12 5	266.69		30.30	28.85 - 29.10 Joint, subvertical dip, stepped, smooth, with 0.5 to 2mm thick grey silt smear, open.	BH terminated at 30.30m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
12-06-19	17.00	28.80	10.50	99	63		
13-06-19	13.00	30.30	10.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

50mm standpipe installed. Response zone from 13.60m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	06-06-19 10-06-19	304.68	E 585,103.0 N 823,398.3

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities / Detail	Main	Geology	Instrument/ Backfill
06-06 0.00						0.00 - 4.80 : overburden.	Open hole drilling - no recovery.		
1.50	0 (-) -	(11) NA			(4.20)				
3.00		(41)							
			300.48		4.20				
4.50				× × ×			Stiff dark greenish brown SILT.		
06-06 4.50		(30/30mm) NA	299.88	× × ×	(0.60) 4.80				
	100 (70) 0					4.80 - 9.10 Non-intact as closely and very closely spaced discontinuities. 4.81 - 30.30 Discontinuities, extremely closely and very closely spaced to 6.90m, then closely spaced, locally very closely and locally medium spaced, dipping 10 to 12°, planar, smooth, with 0.5 to 1mm thick dark grey silt smear and orange brown iron stain to 6.90m.	Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. Locally weak along discontinuities.		
6.10									
06-06	100 (81) 0	NI							
7.60									
06-06	100 (49) 0						8.60m to 9.00m: weak thinly laminated grey silt as possible residual rock.		
9.10									
06-06 9.50	25 (0) 0	NR				9.10 - 9.30 CAVITY. 9.30 - 18.40 Non-intact as closely and very closely spaced discontinuities.			
06-06	100 (67) 0								
11.00									

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
06-06-19	17.00	11.00	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	30.30	polymer	100

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 4.00m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	06-06-19 10-06-19	304.68	E 585,103.0 N 823,398.3

Engineer	Sheet	Rev.
Fehily Timoney & Co	2 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities Detail	Main	Geology	Instrument/ Backfill
06-06 12.50	100 (98) 58					11.10 - 11.35 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear and minor orange brown iron stain, open.	Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. Locally weak along discontinuities. *(continued)*		
06-06 14.00	100 (92) 34	NI							
06-06 15.40	100 (80) 0								
06-06 17.40	100 (71) 18					15.50 - 15.80 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.			
06-06 18.40	100 (72) 15				(25.50)	16.90 - 17.40 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 17.50 - 18.05 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.			
06-06 19.90	93 (47) 0	NR/NI				18.40 - 19.90 Non-intact as closely and very closely spaced discontinuities. No recovery as washout of fines during drilling. No record of cavity.			
06-06 21.30	100 (86) 0					19.60 - 21.30 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 19.90 - 30.30 Non-intact as closely and very closely spaced discontinuities.			
06-06	100								

Drilling Progress and Water Observations								Rotary Flush			
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 4.00m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	06-06-19 10-06-19	304.68	E 585,103.0 N 823,398.3

Engineer	Sheet	Rev.
Fehily Timoney & Co	3 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities	Detail	Main	Geology	Instrument/ Backfill
22.90	(83) 29							Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. Locally weak along discontinuities. *(continued)*		
06-06 24.40	100 (96) 34					23.90 - 24.10 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear, open.				
06-06 26.00	100 (89) 43	NI				24.70 - 25.10 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear, open.				
06-06 27.40	100 (88) 23									
06-06 29.00	100 (95) 30					28.30 - 29.00 2 No parallel joints, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
06-06 30.30	100 (96) 24		274.38		30.30	30.00 - 30.30 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.		BH terminated at 30.30m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
07-06-19	17.00	29.00	4.50	99	63		
12-06-19	12.00	30.30	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 4.00m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit Design: HQ	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	31-05-19 05-06-19	284.32	E 589,961.7 N 822,212.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument / Backfill
31-05 0.00						0.00 - 10.70 : overburden.	Open hole drilling - no recovery.		
1.50	0 (-) -	(76/150mm) NA			(4.40)				
3.00		(50/225mm)							
4.40			279.92		4.40				
31-05 4.50	17 (-) -	(50/75mm)					Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone.		
5.60									
31-05 6.00	40 (-) -	(50/75mm)							
7.10									
31-05	100 (-) -	NA			(6.30)				
8.00									
31-05	20 (-) -								
9.00									
31-05 9.50	40 (-) -								
31-05 10.00	60 (-) -								
31-05	19 (0)		273.62		10.70	10.70 - 14.90 Non-intact as			

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
31-05-19	17.00	7.10	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	10.00	polymer	100
10	30.20	polymer	100

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 10.00m to 30.20m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit Design: HQ	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	31-05-19 05-06-19	284.32	E 589,961.7 N 822,212.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	2 of 3	REV 1

RUN DETAILS						STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
11.60	0					weathered rock.		Weathered SILTSTONE rock. Recovered as fine to coarse gravel sized clasts of weak locally medium strong black fine grained siltstone with some black silt as probable residual rock. *(continued)*		
31-05 13.10	67 (0) 0	NI			(4.20)					
31-05 14.60	67 (0) 0									
31-05 16.10	100 (86) 41	12	269.42		14.90	14.90 - 30.20 Discontinuities, closely spaced, locally very closely spaced, locally medium spaced, dipping 8 to 10°, planar, smooth, with 0.5 to 1mm thick dark grey silt smear.		Medium strong thinly laminated dark blackish grey calcareous fine grained SILTSTONE. Locally weak along discontinuities.		
31-05 17.70	100 (96) 35	18 16				16.50 - 16.65 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 17.00 - 17.40 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
31-05 19.30	100 (94) 78	9				19.10 - 19.85 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 19.60 - 19.85 Joint, subvertical dip, 'U' shaped, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
31-05 20.90	100 (90) 38	15 28						20.60m to 20.64m: weak residual rock. 20.90m to 21.10m: weak residual rock.		
31-05	100 (51) 15	NI								

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
04-06-19	17.00	19.30	9.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 10.00m to 30.20m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	31-05-19 05-06-19	284.32	E 589,961.7 N 822,212.9

Engineer: Fehily Timoney & Co

Sheet 3 of 3

Rev. REV I

RUN DETAILS						STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
22.50								Medium strong thinly laminated dark blackish grey calcareous fine grained SILTSTONE. Locally weak along discontinuities. *(continued)*		
31-05	100 (74) 41	28			(15.30)					
		15								
24.10										
31-05	100 (96) 89	8								
		11								
25.60								UCS @ 25.60m to 27.10m: strong.		
31-05	100 (75) 41	10								
		NI				26.80 - 27.50 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
27.10										
31-05	100 (96) 39	28								
		29				28.00 - 28.70 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
28.60										
31-05	100 (85) 20	28				29.15 - 30.20 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
30.20		10	254.12		30.20					
								BH terminated at 30.20m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
05-06-19	17.00	30.20	9.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 10.00m to 30.20m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit HQ Design	Driller PMcG	Logged By EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	29-05-19 30-05-19	279.24	E 586,737.2 N 821,259.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities	Detail	Main	Geology	Instrument/ Backfill
29-05 0.00						0.00 - 6.20 : overburden.		Open hole drilling - no recovery.		
1.50	0 (-) -	(20/30mm)			(3.00)					
3.00			276.24		3.00					
29-05 3.00		(50/0mm)						Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone.		
4.50	80 (-) -									
29-05 4.50		(50/0mm) NA			(3.20)					
6.00	32 (0) 0	(50/30mm)	273.04		6.20					
6.40						6.20 - 9.80 Non-intact as weathered rock.		Weathered SILTSTONE rock. Recovered as weak thinly laminated black fine grained silts as probable residual rock.		
29-05 7.70	100 (10) 0									
29-05 9.30	100 (30) 0	NI			(3.60)					
29-05	100 (24) 0		269.44		9.80					
10.70						9.80 - 30.20 Discontinuities, extremely closely spaced, locally very closely spaced to 26.00m, then closely, locally medium spaced, dipping 10 to 12°, planar, smooth,		Medium strong thinly laminated dark blackish grey fissile calcareous fine grained SILTSTONE. Locally weak along discontinuities.		
29-05										

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	30.20	polymer	100

GENERAL REMARKS

2 gallons polydrill used. 50mm standpipe installed. Response zone from 3.20m to 30.20m bgl. Co-ordinates may be incorrect due to tree cover.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit Design: HQ	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	29-05-19 30-05-19	279.24	E 586,737.2 N 821,259.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	2 of 3	REV I

RUN DETAILS				STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology / Instrument/ Backfill
12.30	100 (25) 0					with 0.5 to 2mm thick dark grey silt smear. 9.81 - 30.20 Non-intact as extremely closely spaced, locally very closely spaced to 26.00m, then closely spaced, locally medium spaced.	Medium strong thinly laminated dark blackish grey fissile calcareous fine grained SILTSTONE. Locally weak along discontinuities. *(continued)*	
29-05 13.80	100 (27) 0							
29-05 15.30	100 (50) 0							
29-05 16.80	100 (31) 0							
29-05 18.30	100 (35) 0	NI					18.30m to 25.70m: black thinly interlaminated grey.	
29-05 19.80	100 (35) 0							
29-05 21.20	100 (38) 0				(20.40)			
29-05	100							

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
29-05-19	17.00	17.70	3.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used. 50mm standpipe installed. Response zone from 3.20m to 30.20m bgl. Co-ordinates may be incorrect due to tree cover.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

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DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	29-05-19 30-05-19	279.24	E 586,737.2 N 821,259.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	3 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology / Instrument/ Backfill
22.80	(25) 0							Medium strong thinly laminated dark blackish grey fissile calcareous fine grained SILTSTONE. Locally weak along discontinuities. *(continued)*	
29-05 24.10	100 (87) 0								
29-05 25.70	100 (64) 0								
29-05 27.20	100 (84) 0	28						26.00m to 30.20m: dark grey thickly laminated.	
29-05 28.80	100 (84) 38	20				27.00 - 27.30 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick black silt smear, open.			
29-05 30.20	100 (85) 26	22	249.04		30.20	28.00 - 28.40 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick black silt smear, open.			
		15				29.10 - 29.50 Joint, subvertical dip, planar, smooth, clean, open as drilling induced? 29.60 - 30.00 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick black silt smear, open.		BH terminated at 30.20m bgl on REs instruction.	

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
30-05-19	17.00	30.20	6.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

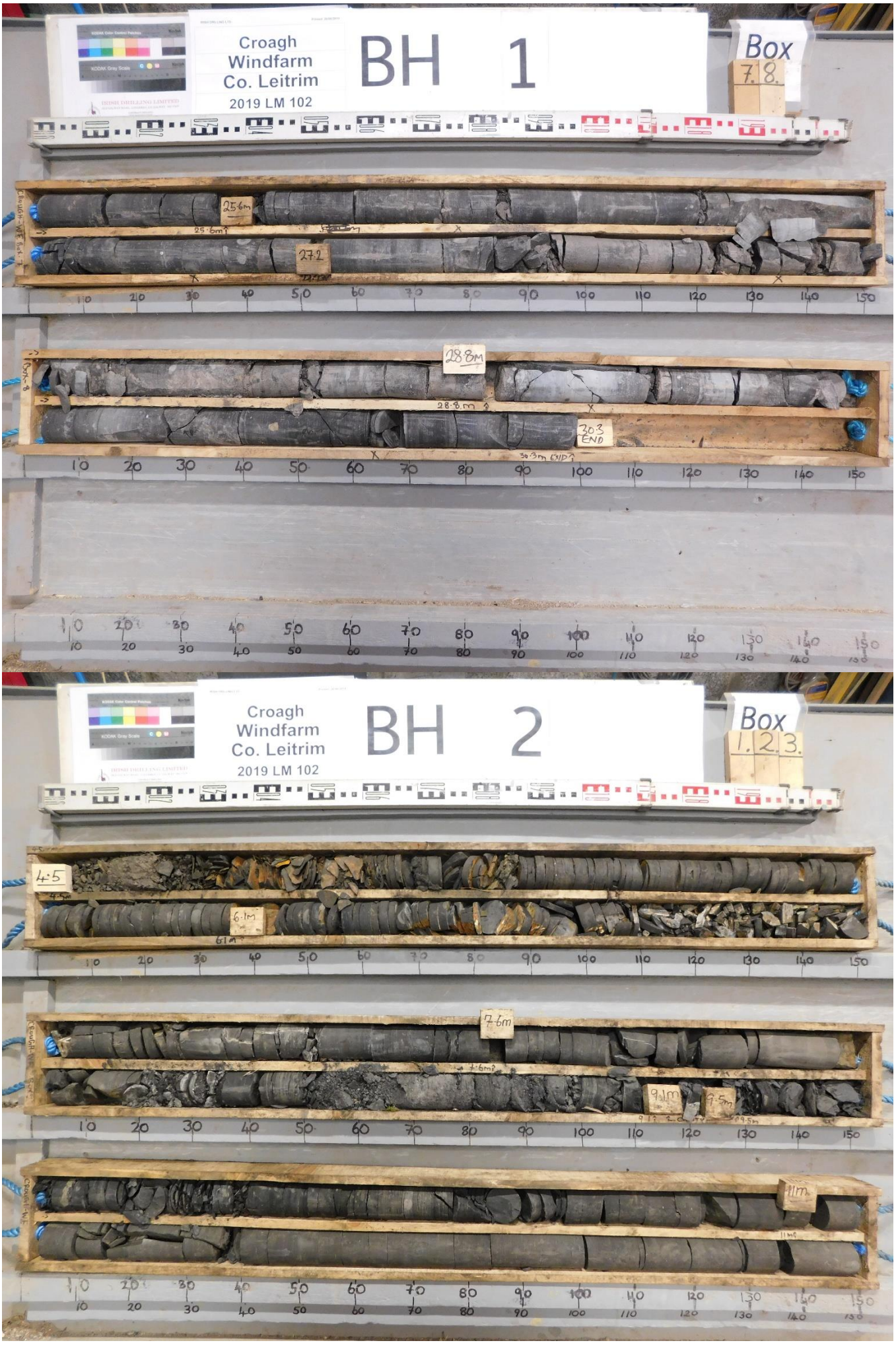
2 gallons polydrill used. 50mm standpipe installed. Response zone from 3.20m to 30.20m bgl. Co-ordinates may be incorrect due to tree cover.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

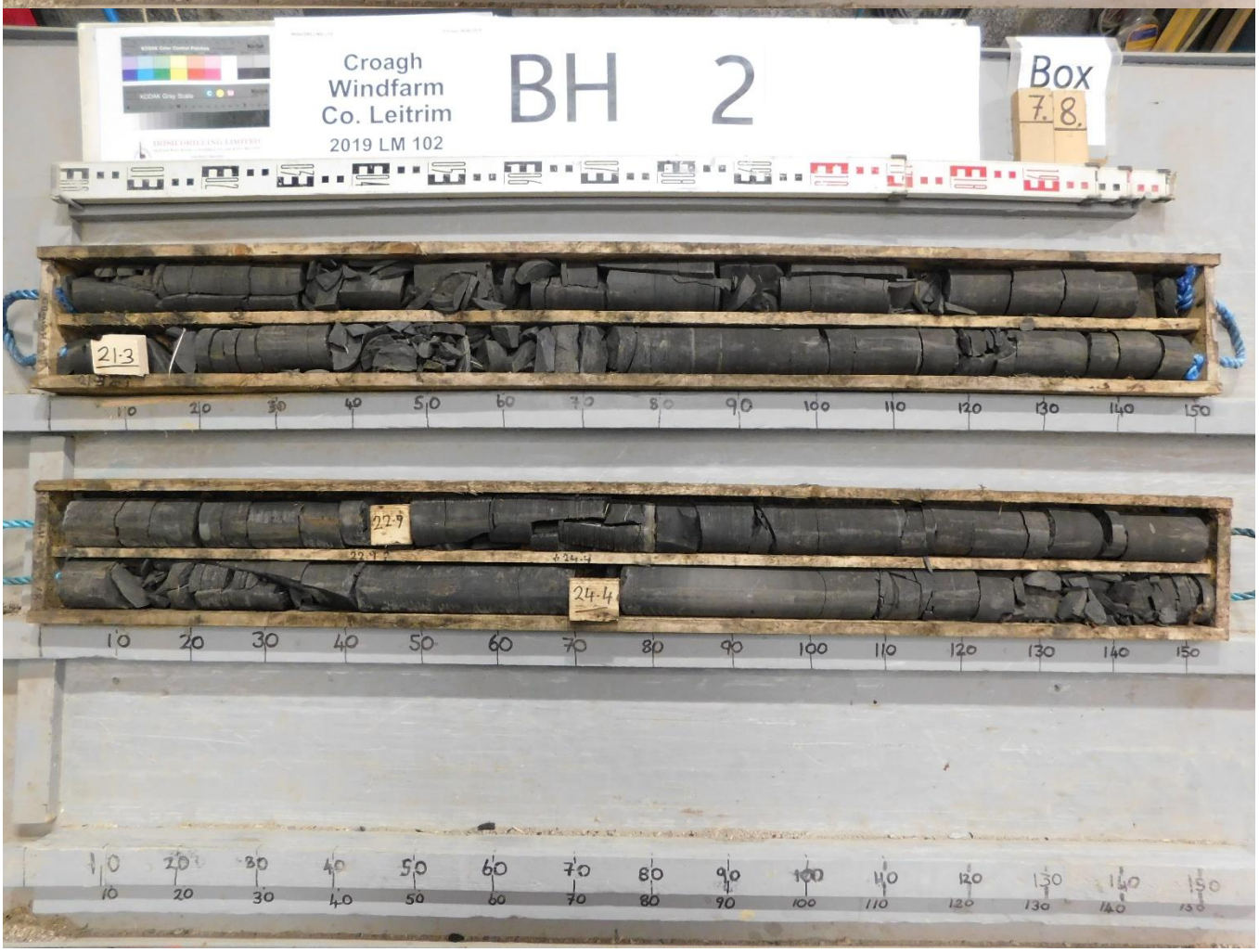
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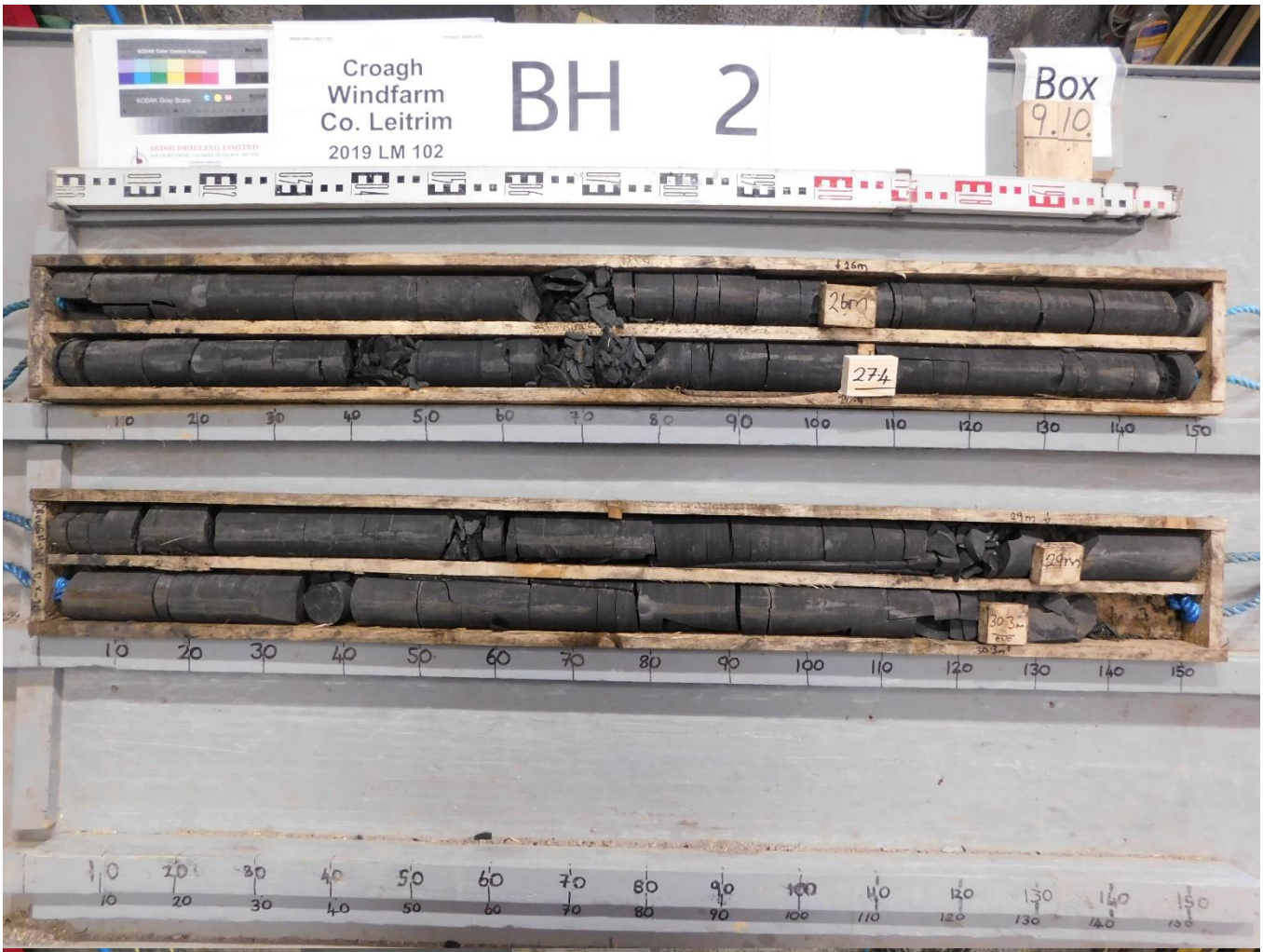

Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 1
Box
1. 2. 3.


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 1
Box
4. 5. 6.


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 1
Box
7.8.
25.6m
27.2
28.8m
30.3 END
Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
1.2.3.
4.5
6.1m
7.6m
9.1m
9.5m
11m


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
4. 5. 6.
12·5
14M
15·4
17M
18·4
19·9


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
7. 8.
21·3
22·9
24·4


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
9.10.
26m
274
29m
303m


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 3
Box
1.2.3.
5.6m
7.1m
8
9M
10M
11.6m
13.1m
16.1
14.6


Croagh
Windfarm
Co. Leitrim
BH 3
2019 LM 102
Box
4. 5. 6.
177
19.3
20.9
225
24.1
256
Croagh
Windfarm
Co. Leitrim
BH 3
2019 LM 102
Box
7. 8.
27.1m
28.6
30.2
END


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
1 2 3
3M START
3M
4.5
6.4
7.7M
9.3
10.7
12.3
Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
4 5 6
13.8
15.3
16.8
18.3
19.8
21.2


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
7.8
228
241
257
Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
9.10
272
288
302
30.2m EOH

IRISH DRILLING LTD.
Loughrea Co. Galway

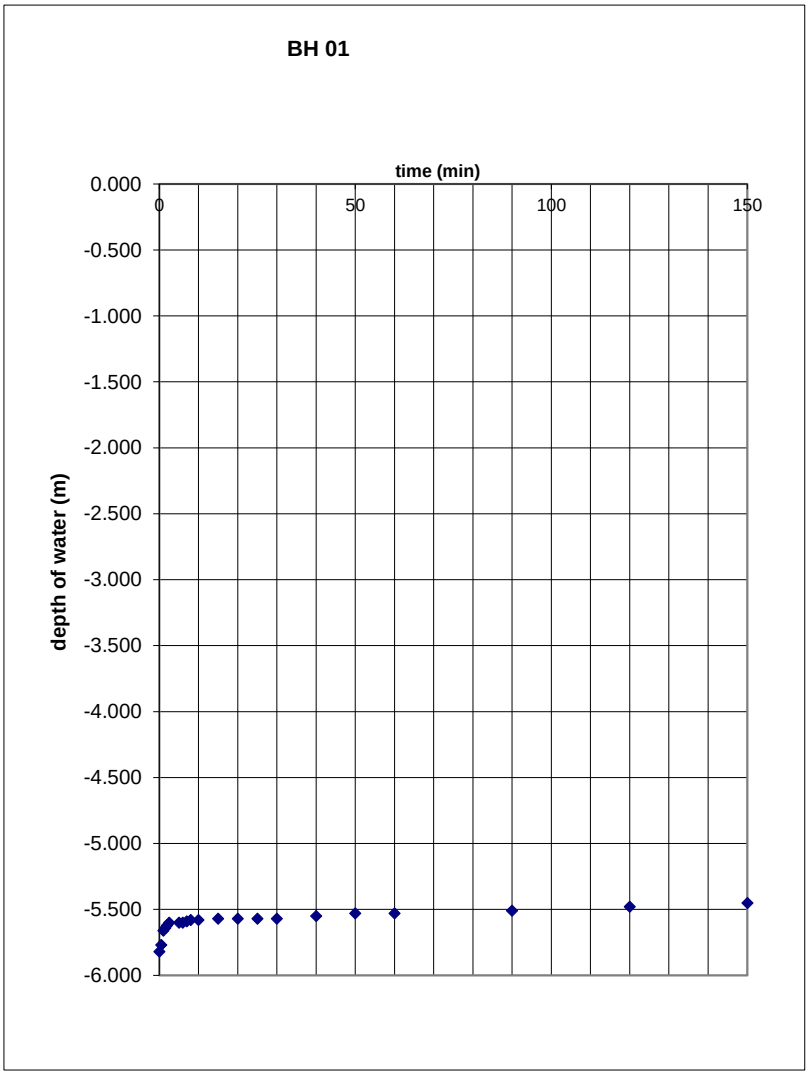
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	24/06/2019
Tested by:	DK

RISING HEAD PERMEABILITY TEST

Borehole:	**BH 01**	*Ground Level:*	296.99mOD
Bottom of Borehole:	30.30m	*Weather;*	Fair
Top of Filter Material	13.60m	*Length of Filter;*	16.70m
Response Zone:	13.60-30.30m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	5.42m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-5.820
0.5	-5.770
1	-5.660
1.5	-5.640
2	-5.620
2.5	-5.600
5	-5.600
6	-5.600
7	-5.590
8	-5.580
10	-5.580
15	-5.570
20	-5.570
25	-5.570
30	-5.570
40	-5.550
50	-5.530
60	-5.530
90	-5.510
120	-5.480
150	-5.450



Remarks:
Water pumped out of borehole at commencement of test at rate of 0.25l per second.

IRISH DRILLING LTD.
Loughrea Co. Galway

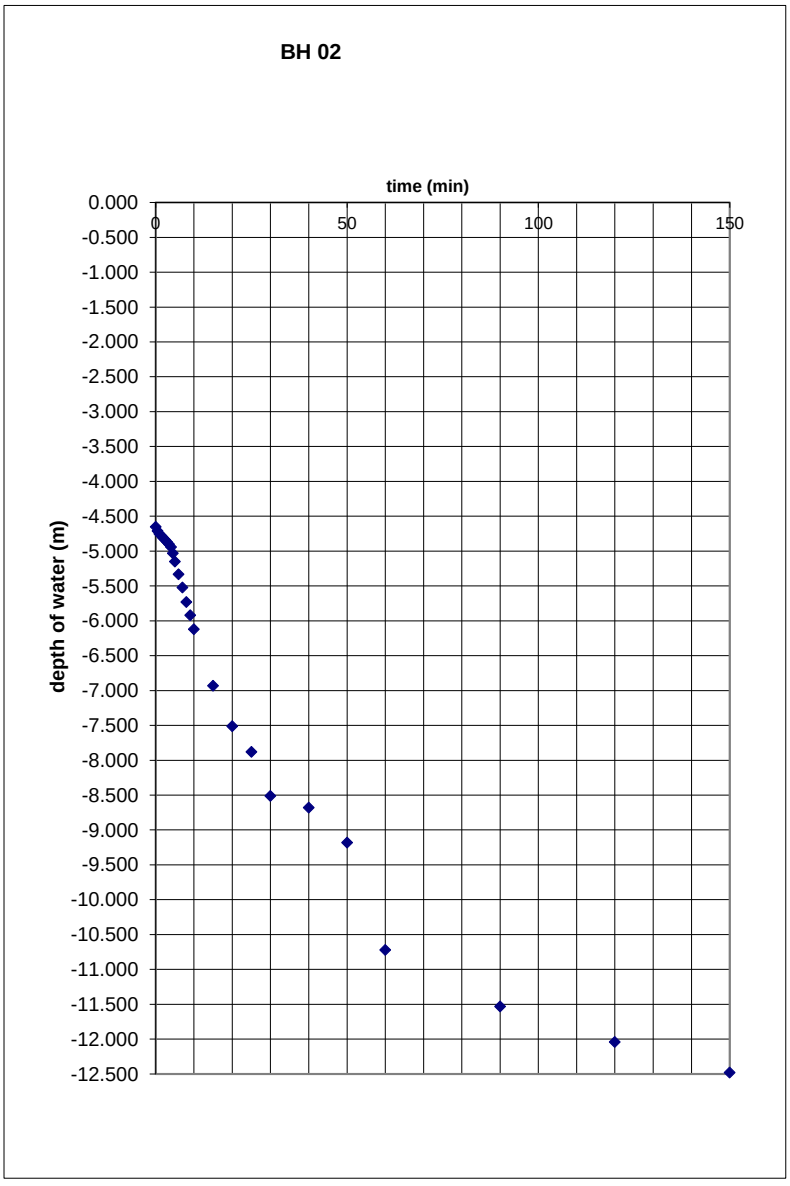
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	24/06/2019
Tested by:	DK

FALLING HEAD PERMEABILITY TEST

Borehole:	**BH 02**	*Ground Level:*	304.68mOD
Bottom of Borehole:	30.30m	*Weather;*	Fair
Top of Filter Material	4.00m	*Length of Filter;*	26.30m
Response Zone:	4.00-30.30m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	12.65m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-4.650
0.5	-4.710
1	-4.750
1.5	-4.780
2	-4.810
2.5	-4.840
3	-4.870
3.5	-4.900
4	-4.940
4.5	-5.030
5	-5.150
6	-5.330
7	-5.520
8	-5.730
9	-5.920
10	-6.120
15	-6.930
20	-7.510
25	-7.880
30	-8.510
40	-8.680
50	-9.180
60	-10.720
90	-11.530
120	-12.040
150	-12.480



Remarks:
50l of water added to borehole at commencement of test.

IRISH DRILLING LTD.
Loughrea Co. Galway

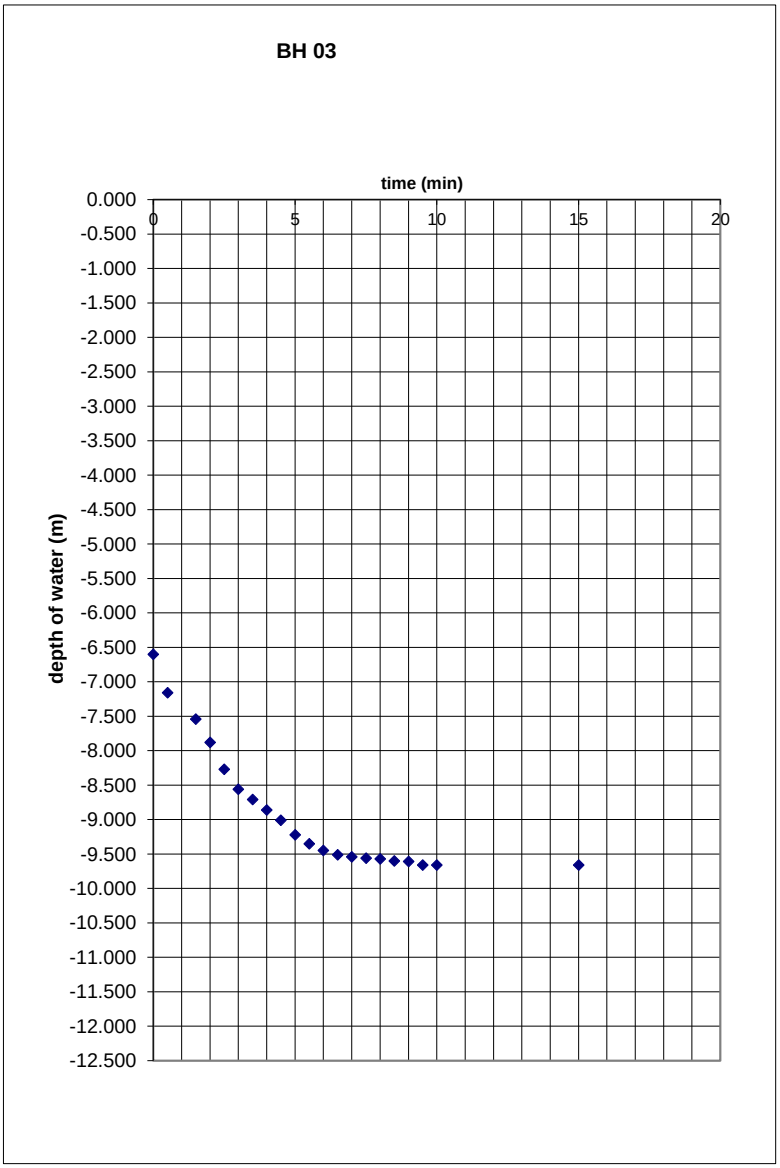
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	25/06/2019
Tested by:	DK

FALLING HEAD PERMEABILITY TEST

Borehole:	**BH 03**	*Ground Level:*	284.32mOD
Bottom of Borehole:	30.20m	*Weather;*	Fair
Top of Filter Material	10.00m	*Length of Filter;*	20.20m
Response Zone:	10.00-30.20m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	9.66m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-6.600
0.5	-7.160
1.5	-7.540
2	-7.880
2.5	-8.270
3	-8.560
3.5	-8.710
4	-8.860
4.5	-9.010
5	-9.220
5.5	-9.350
6	-9.450
6.5	-9.510
7	-9.540
7.5	-9.560
8	-9.570
8.5	-9.600
9	-9.610
9.5	-9.660
10	-9.660
15	-9.660



Remarks:
50l of water added to borehole at commencement of test.

IRISH DRILLING LTD.
Loughrea Co. Galway

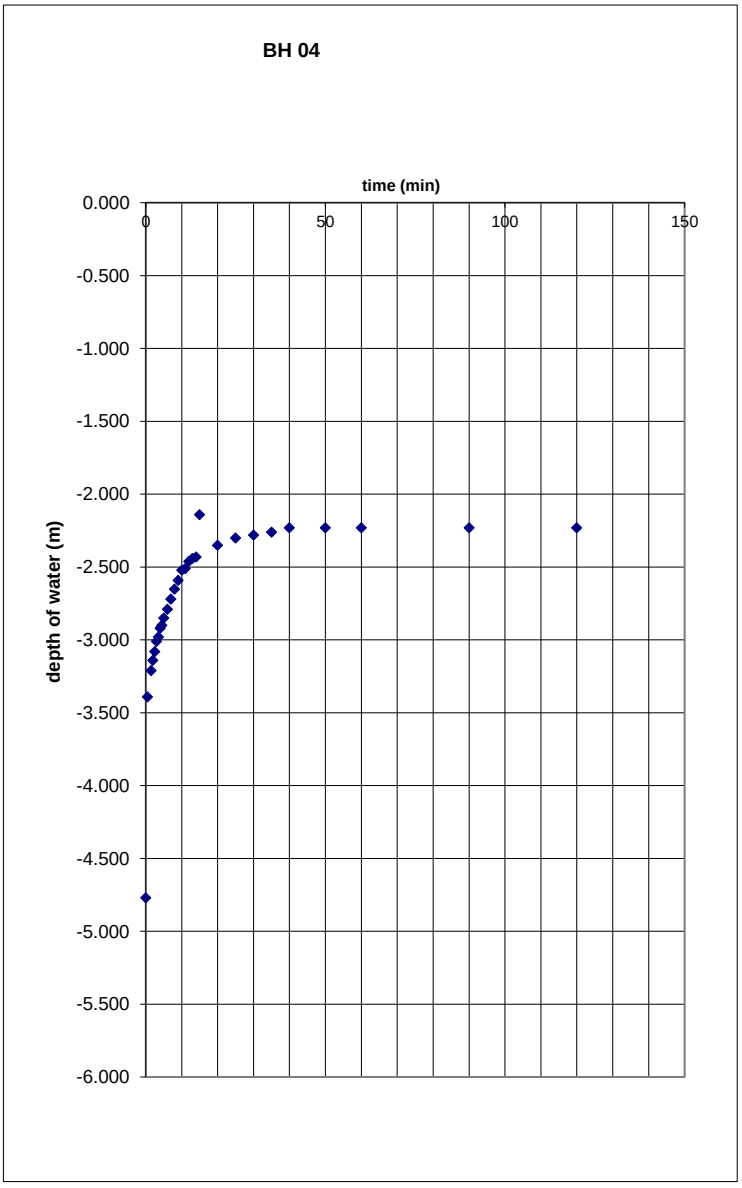
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	24/06/2019
Tested by:	DK

RISING HEAD PERMEABILITY TEST

Borehole:	**BH 04**	*Ground Level:*	279.24mOD
Bottom of Borehole:	30.20m	*Weather;*	Fair
Top of Filter Material	3.20m	*Length of Filter;*	27.00m
Response Zone:	3.20m-30.20m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	1.76m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-4.770
0.5	-3.390
1.5	-3.210
2	-3.140
2.5	-3.080
3	-3.010
3.5	-2.980
4	-2.920
4.5	-2.900
5	-2.850
6	-2.790
7	-2.720
8	-2.650
9	-2.590
10	-2.520
11	-2.510
12	-2.460
13	-2.440
14	-2.430
15	-2.140
20	-2.350
25	-2.300
30	-2.280
35	-2.260
40	-2.230
50	-2.230
60	-2.230
90	-2.230
120	-2.230



Remarks:
Water pumped out of borehole at commencement of test at rate of 0.25l per second.

IRISH DRILLING LTD.
Loughrea Co. Galway

Tel: (091) 841274 Fax: (091) 880861

Operator DK
Checked: RK

Water Levels in Standpipe Piezometers

Boreholes	Date 24.06.2019	Date 25.06.2019	Response Zone (m bgl)	Installation Type
BH 01	5.42m		13.60m -30.30m	50mm Standpipe
BH 02	12.65m		4.00m - 30.30m	50mm Standpipe
BH 03		9.66m	10.00m - 30.20m	50mm Standpipe
BH 04		1.76m	3.20m - 30.20m	50mm Standpipe

Remarks:
All readings record depth from ground level to top of static water level (m bgl).

Project ID	2019LM102
roject Name	Croagh Wind Farm, Co. Leitrim
Schedule ID	2019LM102_2

Turnaround

Sample Details						Shear Stregth (Effective Stress)			Rock		Other							
Location	Depth (m)	Base Depth	Sample Type	Sample Ref	Date Sampled	Consolidated Drained Triaxial Test	Consolidated Undrained Triaxial Test	Consolidated Undrained Triaxial Multi	Rock Uniaxial compression	Point Load (set of 10)	LAA Test	Magnesium Sulphate Soundness	Slake Durability					
BH01	0.00	4.20	C		11/06/19													
BH01	4.20	4.60	C		11/06/19													
BH01	4.60	5.10	C		11/06/19													
BH01	5.10	6.10	C		11/06/19													
BH01	6.10	7.80	C		11/06/19													
BH01	7.80	9.20	C		11/06/19													
BH01	9.20	9.60	C		11/06/19													
BH01	9.60	10.80	C		11/06/19													
BH01	10.80	12.20	C		12/06/19													
BH01	12.20	13.80	C		12/06/19													
BH01	13.80	15.20	C		12/06/19													
BH01	15.20	16.80	C		12/06/19													
BH01	16.80	18.20	C		12/06/19													
BH01	18.20	19.60	C		12/06/19													
BH01	19.60	21.20	C		12/06/19													
BH01	21.20	22.80	C		12/06/19													
BH01	22.80	24.40	C		12/06/19													
BH01	24.40	25.60	C		12/06/19													
BH01	25.60	27.20	C		12/06/19													
BH01	27.20	28.80	C		12/06/19													
BH01	28.80	30.30	C		13/06/19													
BH02	0.00	4.50	C		06/06/19													
BH02	4.50	6.10	C		06/06/19					5							Not possible to test 10 pieces	idl
BH02	6.10	7.60	C		06/06/19				0*								*not suitable	idl
BH02	7.60	9.10	C		06/06/19						1							Celtest sent 16.7.19
BH02	9.10	9.50	C		06/06/19													
BH02	9.50	11.00	C		06/06/19							1						Celtest sent 16.7.19
BH02	9.50	11.00	C		06/06/19					5							Not possible to test 10 pieces	idl
BH02	11.00	12.50	C		07/06/19													
BH02	12.50	14.00	C		07/06/19								1					Celtest sent 16.7.19
BH02	14.00	15.40	C		07/06/19				0*								*not suitable	idl
BH02	15.40	17.40	C		07/06/19						1							Celtest sent 16.7.19
BH02	17.40	18.40	C		07/06/19													
BH02	18.40	19.90	C		07/06/19													
BH02	19.90	21.30	C		07/06/19													
BH02	21.30	22.90	C		07/06/19					5							Not possible to test 10 pieces	idl
BH02	22.90	24.40	C		07/06/19													
BH02	24.40	26.00	C		07/06/19													
BH02	26.00	27.40	C		07/06/19													
BH02	27.40	29.00	C		07/06/19													
BH02	29.00	30.30	C		10/06/19													
BH03	0.00	4.40	C		31/05/19													
BH03	4.40	5.60	C		31/05/19													
BH03	5.60	7.10	C		31/05/19													
BH03	7.10	8.00	C		04/06/19													
BH03	8.00	9.00	C		04/06/19													
BH03	9.00	9.50	C		04/06/19													
BH03	9.50	10.00	C		04/06/19													
BH03	10.00	11.60	C		04/06/19							1						Celtest sent 16.7.19
BH03	11.60	13.10	C		04/06/19					0*							*too soft to test	idl
BH03	13.10	14.60	C		04/06/19						1							Celtest sent 16.7.19
BH03	14.60	16.10	C		04/06/19				0*								*not suitable	idl
BH03	16.10	17.70	C		04/06/19					5							Not possible to test 10 pieces	idl
BH03	17.70	19.30	C		04/06/19								1					Celtest sent 16.7.19
BH03	19.30	20.90	C		05/06/19													
BH03	20.90	22.50	C		05/06/19						1							Celtest sent 16.7.19
BH03	22.50	24.10	C		05/06/19					5							Not possible to test 10 pieces	idl
BH03	24.10	25.60	C		05/06/19													
BH03	25.60	27.10	C		05/06/19				1									idl
BH03	27.10	28.60	C		05/06/19													
BH03	28.60	30.20	C		05/06/19													
BH04	0.00	3.00	C		29/05/19													
BH04	3.00	4.50	C		29/05/19													
BH04	4.50	6.40	C		29/05/19													

Project ID	2019LM102
roject Name	Croagh Wind Farm, Co. Leitrim
Schedule ID	2019LM102_2

Turnaround

Sample Details						Shear Stregth (Effective Stress)			Rock		Other						
Location	Depth (m)	Base Depth	Sample Type	Sample Ref	Date Sampled	Consolidated Drained Triaxial Test	Consolidated Undrained Triaxial Test	Consolidated Undrained Triaxial Multi	Rock Uniaxial compression	Point Load (set of 10)	LAA Test	Magnesium Sulphate Soundness	Slake Durability				
BH04	6.40	7.70	C		29/05/19					**0***							*too soft to test idl
BH04	7.70	9.30	C		29/05/19							**1**					Celtest sent 16.7.19
BH04	7.70	9.30	C		29/05/19				**0***								*not suitable idl
BH04	9.30	10.70	C		29/05/19						**1**						Celtest sent 16.7.19
BH04	10.70	12.30	C		29/05/19					**0***							*too soft to test idl
BH04	12.30	13.80	C		29/05/19								**1**				Celtest sent 16.7.19
BH04	13.80	15.30	C		29/05/19				**0***								*not suitable idl
BH04	15.30	16.80	C		29/05/19						**1**						Celtest sent 16.7.19
BH04	16.80	18.30	C		30/05/19					**0***							*too soft to test idl
BH04	18.30	19.80	C		30/05/19												
BH04	19.80	21.20	C		30/05/19												
BH04	21.20	22.80	C		30/05/19												
BH04	22.80	24.10	C		30/05/19												
BH04	24.10	25.70	C		30/05/19												
BH04	25.70	27.20	C		30/05/19												
BH04	27.20	28.80	C		30/05/19												
BH04	28.80	30.20	C		30/05/19												

Number Completed: 15.08.19 1 25 6 3 3

IDL

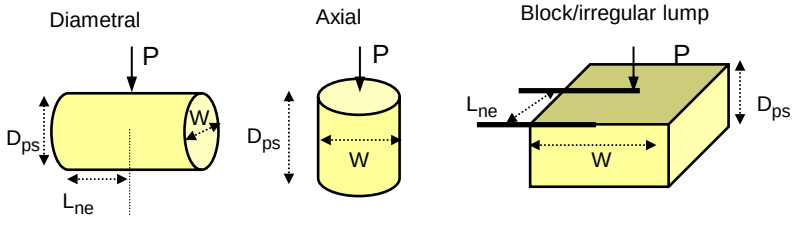
Point Load Strength Index Tests
Summary of Results

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Ref	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH02	4.50	6.1	C	5.12	5.15		A	P	YES		63.1		22.1	3.6	42.1	2.0	1.9	Med Strong
BH02	4.50	6.1	C	5.58	5.61		A	P	YES		63.1		27.0	4.2	46.6	2.0	1.9	Med Strong
BH02	4.50	6.1	C	5.72	5.75		A	P	YES		63.1		21.2	2.2	41.3	1.3	1.2	Med Strong
BH02	4.50	6.1	C	5.88	5.90		A	P	YES		63.1		20.4	1.9	40.5	1.1	1.0	Weak
BH02	4.50	6.1	C	6	6.03		A	P	YES		63.1		19.5	1.9	39.6	1.2	1.1	Med Strong
BH02	9.50	11	C	10.3	10.30		D	L	YES		63.1		54.2	0.3	58.5	0.1	0.1	Very Weak
BH02	9.50	11	C	10.5	10.60		A	P	YES		63.1		31.0	0.5	49.9	0.2	0.2	Weak
BH02	9.50	11	C	10.8	11.00		D	L	YES		63.1		82.0	0.2	71.9	0.0	0.0	Very Weak
BH02	9.50	11	C	9.6	9.63		A	P	YES		63.1		21.0	0.1	41.1	0.0	0.0	Very Weak
BH02	9.50	11	C	9.65	9.70		A	P	YES		63.1		23.4	0.1	43.4	0.1	0.1	Very Weak
BH02	21.30	22.9	C	21.3	21.36		D	L	YES		63.1		63.1	0.4	63.1	0.1	0.1	Very Weak
BH02	21.30	22.9	C	21.5	21.54		D	L	YES		63.1		63.1	1.1	63.1	0.3	0.3	Weak
BH02	21.30	22.9	C	22.1	22.14		A	P	YES		63.1		54.0	1.3	65.9	0.3	0.3	Weak
BH02	21.30	22.9	C	22.6	22.71		A	P	YES		63.1		42.5	1.1	58.4	0.3	0.4	Weak
BH02	21.30	22.9	C	22.7	22.80		D	L	YES		63.1		63.1	1.7	63.1	0.4	0.5	Weak
BH03	16.10	17.7	C	16.3	16.37		D	L	YES		63.1		63.1	0.2	63.1	0.0	0.0	Very Weak
BH03	16.10	17.7	C	16.7	16.74		D	L	YES		63.1		63.1	0.3	63.1	0.1	0.1	Very Weak
BH03	16.10	17.7	C	17.1	17.14		D	L	YES		63.1		63.1	2.3	63.1	0.6	0.6	Weak
BH03	16.10	17.7	C	17.2	17.30		D	L	YES		63.1		63.1	2.1	63.1	0.5	0.6	Weak
BH03	16.10	17.7	C	17.5	17.59		D	L	YES		63.1		63.1	2.3	63.1	0.6	0.6	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 16/07/2019

Approved By: APPROVED By DCD at 10:56 am, Aug 15, 2019

Table: 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IDL

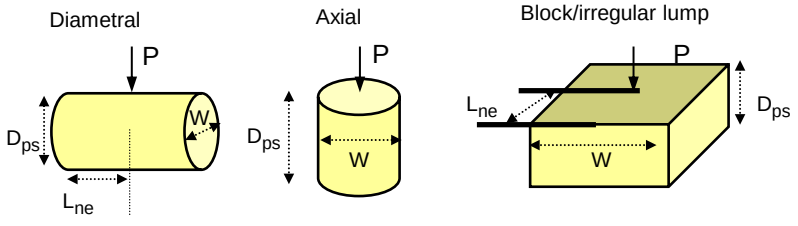
Point Load Strength Index Tests
Summary of Results

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Ref	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH03	22.50	24.1	C	22.5	22.54		D	L	YES		63.1		63.1	0.4	63.1	0.1	0.1	Very Weak
BH03	22.50	24.1	C	22.5	22.64		D	L	YES		63.1		63.1	3.2	63.1	0.8	0.9	Weak
BH03	22.50	24.1	C	22.8	22.86		D	L	YES		63.1		63.1	4.1	63.1	1.0	1.1	Med Strong
BH03	22.50	24.1	C	24	24.10		D	L	YES		63.1		63.1	3.1	63.1	0.8	0.9	Weak
BH03	22.50	24.1	C	232	23.54		D	L	YES		63.1		63.1	3.2	63.1	0.8	0.9	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 16/07/2019

Approved By: APPROVED By DCD at 10:56 am, Aug 15, 2019

Table 1 sheet 2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IDL

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Hole No.	Sample				Specimen Depth (m)	Specimen Dimensions2			Bulk Density2	Water Content 1	Uniaxial Compression3				Remarks
	Ref	Top	Base	Type		Dia. mm	Length mm	H/D	Mg/m3	%	Condition	Stress Rate MPa/s	Mode of failure	UCS MPa	
BH03		25.60	27.10	C	25.66-25.88	63.4	166.6	2.6	2.49		as received	0.3673	F	80.1	Strong

Notes

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

Test Specification: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Date Printed: 16/07/2019

Approved By: APPROVED By DCD at 10:56 am, Aug 15, 2019

Table 1 sheet 1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684237

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Slake Durability Index of an aggregate sample in accordance with **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. :	**BH02 - 12.50 - 14.00**
Date and Time of Sampling:	**07/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	

RESULTS:

Slake Durability Index = **83.2 %**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684238

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH02 - 15.40 - 17.40**
Date and Time of Sampling:	**07/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **48**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684242

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH02 - 7.60 - 9.10**
Date and Time of Sampling:	**06/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **48**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 13 August 2019
Test Report Ref: TR 684243

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Magnesium Sulfate Value of aggregate sample within the size range 10mm to 14mm in accordance with **BS EN 1367-2 : 2009**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH02 - 9.50 - 11.00**
Date and Time of Sampling:	**06/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**30/07/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Magnesium Sulfate Value Portion 1 (MS_1) = 79.8
Magnesium Sulfate Value Portion 2 (MS_2) = 94.6

Mean Magnesium Sulfate Value (MS) = 87

Comments	Report checked and approved by:
Proportion by mass of laboratory sample used for the test portion = 5% (nearest 5%)	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 13 August 2019
Test Report Ref: TR 684239

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Magnesium Sulfate Value of aggregate sample within the size range 10mm to 14mm in accordance with **BS EN 1367-2 : 2009**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH03 - 10.00 - 11.60**
Date and Time of Sampling:	**04/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**30/07/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Magnesium Sulfate Value Portion 1 (MS_1) = 89.7
Magnesium Sulfate Value Portion 2 (MS_2) = 91.4

Mean Magnesium Sulfate Value (MS) = 91

Comments	Report checked and approved by:
Proportion by mass of laboratory sample used for the test portion = 20% (nearest 5%)	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684240

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH03 - 13.10 - 14.60**
Date and Time of Sampling:	**04/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **46**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684241

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Slake Durability Index of an aggregate sample in accordance with **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. :	**BH03 - 17.70 - 19.30**
Date and Time of Sampling:	**04/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	

RESULTS:

Slake Durability Index = **98.3 %**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684230

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH03 - 20.90 - 22.50**
Date and Time of Sampling:	**05/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **44**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684234

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Slake Durability Index of an aggregate sample in accordance with **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. :	**BH04 - 12.30 - 13.80**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	

RESULTS:

Slake Durability Index = **70.5 %**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684236

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH04 - 15.30 - 16.80**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **33**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

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INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 13 August 2019
Test Report Ref: TR 684231

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Magnesium Sulfate Value of aggregate sample within the size range 10mm to 14mm in accordance with **BS EN 1367-2 : 2009**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH04 - 7.70 - 9.30**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**30/07/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Magnesium Sulfate Value Portion 1 (MS_1) = 54.3
Magnesium Sulfate Value Portion 2 (MS_2) = 55.5

Mean Magnesium Sulfate Value (MS) = 55

Comments	Report checked and approved by:
Proportion by mass of laboratory sample used for the test portion = 5% (nearest 5%)	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684232

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH04 - 9.30 - 10.70**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **40**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

Appendix E

Peat Stability Risk Register






Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T1**

Grid Reference (Eastings, Northings):	**583322**	**823639**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8 to 2.2**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 3.59 (u), 3.48 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		2	1	2	Negligible
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T1**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T2**

Grid Reference (Eastings, Northings):	**583831**	**824112**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8 to 2.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 4.53 (u), 4.10 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	2	1	2	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T2**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (eg. boulders, retaining wall units) or excavation face battered to shallow angle - temporary works designer may be required to provide excavation support design - daily detailed inspection of excavation faces - potential for greater water inflow into excavation requiring removal of water using pumping - increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T3**

Grid Reference (Eastings, Northings):	**583648**	**823314**
Distance to Watercourse (m)	**50 - 100**	
Min & Max Measured Peat Depth (m):	**1.9 to 2.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 4.53 (u), 4.10 (d)	1	3	3	Negligible	No		1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	2	3	6	Low	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	1	3	3	Negligible	No	See Below	1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	3	3	9	Low	No		1	3	3	Negligible
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Relatively deep peat	2	3	6	Low	Yes		1	3	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T3**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (eg. boulders, retaining wall units) or excavation face battered to shallow angle - temporary works designer may be required to provide excavation support design - daily detailed inspection of excavation faces - potential for greater water inflow into excavation requiring removal of water using pumping - increased exclusion zone around excavation to avoid accidental loading of crest of slope - possibly construct using piled foundation due to depth of peat and soft underlying deposits, TBC following ground investigation at detailed design stage
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T4**

Grid Reference (Eastings, Northings):	**584223**	**823820**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.5 to 1.0**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.48 (u), 1.97 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	1	3	Negligible	No	See Below	2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T4**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T5**

Grid Reference (Eastings, Northings):	**584259**	**823347**
Distance to Watercourse (m)	**100 - 150**	
Min & Max Measured Peat Depth (m):	**0.3 to 1.3**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 7.48 (u), 8.82 (d)	1	2	2	Negligible	No		1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	1	2	2	Negligible	No		1	2	2	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	2	2	Negligible	No	See Below	1	2	2	Negligible
7	Evidence of very soft/soft clay at base of peat	3	2	6	Low	No		1	2	2	Negligible
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T5**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T6**

Grid Reference (Eastings, Northings):	**584841**	**823616**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8 to 2.4**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.06 (u), 4.78 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T6**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T7**

Grid Reference (Eastings, Northings):	**584968**	**823032**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.0 to 2.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 8.23 (u), 7.44 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	3	1	3	Negligible	Yes		1	1	1	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	2	1	2	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T7**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (eg. boulders, retaining wall units) or excavation face battered to shallow angle - temporary works designer may be required to provide excavation support design - daily detailed inspection of excavation faces - potential for greater water inflow into excavation requiring removal of water using pumping - increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T8**

Grid Reference (Eastings, Northings):	**585523**	**822935**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**3.3 to 3.9**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.90 (u), 1.59 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	3	1	3	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	3	1	3	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Deep peat	3	1	3	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T8**
i	Due to deep peat at this turbine location, additional construction measures such as the following may be required: - access the working area possibly formed using bog mats with the addition of temporary working platform - detailed ground investigation to determine peat, mineral soil and bedrock condition and properties for design stage - detailed design of access platforms and temporary working platforms to be carried out in advance of construction works - possibly construct using piled foundation due to depth of peat and soft underlying deposits, TBC following ground investigation at detailed design stage - install piling/working platform required for the construction of turbine base foundation, as required - monitoring (in the form of timber stakes as sightlines) to be installed in area of turbine base and to be monitored regularly during the construction works - where piling is adopted, site trial of piling works and potential issues to be identified prior to commencing construction - where piling is adopted, testing of piles to be carried out in accordance with latest standards to ensure design assumptions are satisified
ii	Use of experienced geotechnical staff for construction supervision, monitoring works, etc.;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Maintain hydrology of area as far as possible.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T9**

Grid Reference (Eastings, Northings):	**586144**	**822595**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.1 to 4.5**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.09 (u), 1.69 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	3	1	3	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	3	1	3	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Deep peat	3	1	3	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T9**
i	Due to deep peat at this turbine location, additional construction measures such as the following may be required: - access the working area possibly formed using bog mats with the addition of temporary working platform - detailed ground investigation to determine peat, mineral soil and bedrock condition and properties for design stage - detailed design of access platforms and temporary working platforms to be carried out in advance of construction works - possibly construct using piled foundation due to depth of peat and soft underlying deposits, TBC following ground investigation at detailed design stage - install piling/working platform required for the construction of turbine base foundation, as required - monitoring (in the form of timber stakes as sightlines) to be installed in area of turbine base and to be monitored regularly during the construction works - where piling is adopted, site trial of piling works and potential issues to be identified prior to commencing construction - where piling is adopted, testing of piles to be carried out in accordance with latest standards to ensure design assumptions are satisified
ii	Use of experienced geotechnical staff for construction supervision, monitoring works, etc.;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Maintain hydrology of area as far as possible.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Turbine T10**

Grid Reference (Eastings, Northings):	**584676**	**822493**
Distance to Watercourse (m)	**50 - 100**	
Min & Max Measured Peat Depth (m):	**0.8 to 1.0**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.89 (u), 3.85 (d)	1	3	3	Negligible	No		1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	3	6	Low	No	See Below	1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	3	3	9	Low	No		1	3	3	Negligible
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Other	0	3	0	Not Applicable	No		0	3	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T10**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Substation**

Grid Reference (Eastings, Northings):	**584584**	**823867**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.9 to 1.7**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.13 (u), 7.39 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Substation**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Const. Comp. 1**

Grid Reference (Eastings, Northings):	**584170**	**823980**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.7 to 1.6**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.92 (u), 2.56 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	1	3	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound 1**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Const. Comp. 2**

Grid Reference (Eastings, Northings):	**585150**	**823232**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.3 to 1.9**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.19 (u), 2.58 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound 2**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Croagh Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Met. Mast**

Grid Reference (Eastings, Northings):	**584059**	**823136**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.0 to 1.2**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.98 (u), 2.42 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Met. Mast**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Appendix F

Calculated FOS For Peat Slopes









Calculated FoS of Natural Peat Slopes for Croagh Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
AT1	583322	823639	3	6	10	2.2	3.2	**5.22**	**3.59**
AT2	583831	824112	2	6	10	2.8	3.8	**6.14**	**4.53**
AT3	583648	823314	2	6	10	2.8	3.8	**6.14**	**4.53**
AT4	584223	823820	12	6	10	1	2.0	**2.95**	**1.48**
AT5	584259	823347	2	6	10	1.3	2.3	**13.23**	**7.48**
AT6	584841	823616	2	6	10	2.4	3.4	**7.17**	**5.06**
AT7	584968	823032	1.1	6	10	2.8	3.8	**11.16**	**8.23**
AT8	585523	822935	3.7	6	10	3.9	4.9	**2.39**	**1.90**
AT9	586144	822595	3	6	10	4.5	5.5	**2.55**	**2.09**
AT10	584676	822493	6	6	10	1	2.0	**5.77**	**2.89**
Amet	583166	823847	8	6	10	1.2	2.2	**3.63**	**1.98**
Amet - SS	584503	823160	1.2	6	10	8.2	9.2	**3.49**	**3.11**
AT1 - SS	583313	823651	4.5	6	10	1.8	2.8	**4.26**	**2.74**
AT2 - SS	583799	824070	2.5	6	10	2	3.0	**6.88**	**4.59**
AT5 - SS	584263	823319	5.6	6	10	1.3	2.3	**4.75**	**2.69**
AT9 - SS	586026	822642	3	6	10	5.6	6.6	**2.05**	**1.74**
A54	586897	821078	9.8	6	10	0.2	1.2	**17.89**	**2.98**
A56	586749	821210	6.1	6	10	0.7	1.7	**8.11**	**3.34**
A57	586660	821254	1.8	6	10	0.3	1.3	**63.70**	**14.70**
A58	586570	821298	9.8	6	10	0.4	1.4	**8.94**	**2.56**
A59	586475	821330	7	6	10	0.2	1.2	**24.80**	**4.13**
A60	586383	821369	10	6	10	0.6	1.6	**5.85**	**2.19**
A61	586305	821427	10	6	10	0.9	1.9	**3.90**	**1.85**
A62	586244	821504	4.7	6	10	1.3	2.3	**5.65**	**3.19**
A63	586216	821600	7.2	6	10	1.4	2.4	**3.45**	**2.01**
A64	586205	821699	7	6	10	0.9	1.9	**5.51**	**2.61**
A82	585214	823103	0.4	6	10	1.7	2.7	**50.56**	**31.83**
A91	584771	823851	4.2	6	10	1.3	2.3	**6.32**	**3.57**
A93	584587	823894	4.2	6	10	0.6	1.6	**13.69**	**5.13**
A94	584497	823852	10	6	10	0.2	1.2	**17.54**	**2.92**
A96	584340	823762	8.7	6	10	0.3	1.3	**13.38**	**3.09**
A98	584225	823914	7.5	6	10	0.9	1.9	**5.15**	**2.44**
A112	584991	822592	4.1	6	10	1.7	2.7	**4.95**	**3.12**
A113	584892	822597	1.9	6	10	2.6	3.6	**6.96**	**5.03**
A114	584794	822615	3.2	6	10	1.9	2.9	**5.67**	**3.71**
A118	585353	822956	3.7	6	10	2.6	3.6	**3.58**	**2.59**
A119	585450	822936	1.8	6	10	2.7	3.7	**7.08**	**5.17**
A120	585544	822904	3	6	10	2.9	3.9	**3.96**	**2.94**
A135	584296	823698	14.6	6	10	0.2	1.2	**12.30**	**2.05**
A136	584239	823617	9.6	6	10	0.9	1.9	**4.05**	**1.92**
A146	583873	823500	3	6	10	3.2	4.2	**3.59**	**2.73**
A166	584905	823362	0.2	6	10	2.7	3.7	**63.66**	**46.46**
A167	584813	823323	0.6	6	10	4.5	5.5	**12.73**	**10.42**
A168	584723	823281	2.1	6	10	5	6.0	**3.28**	**2.73**
A169	584638	823228	2.5	6	10	2.2	3.2	**6.26**	**4.30**
A170	584572	823193	1.1	6	10	2.6	3.6	**12.02**	**8.68**
WP007	587148	821010	9.1	6	10	1	2.0	**3.84**	**1.92**
WP008	587028	821024	6.8	6	10	1.1	2.1	**4.64**	**2.43**
WP010	585013	823067	2.3	6	10	2.8	3.8	**5.34**	**3.94**
WP011	585140	823251	7.6	6	10	1.9	2.9	**2.41**	**1.58**
WP012	585159	823246	7.6	6	10	1.4	2.4	**3.27**	**1.91**
WP013	585147	823265	5.2	6	10	1.8	2.8	**3.69**	**2.37**
WP014	584747	823868	5.7	6	10	0.5	1.5	**12.14**	**4.05**
WP017	584190	824022	12	6	10	0.4	1.4	**7.38**	**2.11**
WP018	584187	824047	6	6	10	0.7	1.7	**8.25**	**3.40**
WP022	583414	823650	7.1	6	10	1.8	2.8	**2.72**	**1.75**
WP023	583833	823524	5.6	6	10	1	2.0	**6.18**	**3.09**
WP024	584274	823299	4.1	6	10	2.6	3.6	**3.24**	**2.34**
WP025	584280	823343	4.6	6	10	0.8	1.8	**9.38**	**4.17**
WP027	585363	822726	4.7	6	10	2.2	3.2	**3.34**	**2.30**
mk0v1_79	584960	822641	2.1	6	10	3	4.0	**5.46**	**4.10**
mk0v1_93	584955	823020	2.9	6	10	3.8	4.8	**3.12**	**2.47**
mk0v1_112	583295	823649	4.6	6	10	2.2	3.2	**3.41**	**2.35**
mk0v1_114	583364	823610	4.6	6	10	1.9	2.9	**3.95**	**2.59**
mk0v1_115	583340	823607	5.5	6	10	2	3.0	**3.14**	**2.10**
mk0v1_116	583394	823575	7.4	6	10	1.6	2.6	**2.94**	**1.81**
mk0v1_117	583444	823588	6.7	6	10	1.6	2.6	**3.24**	**1.99**
mk0v1_129	584319	823738	12.1	6	10	1.8	2.8	**1.63**	**1.05**
mk0v1_130	584319	823672	4.2	6	10	1.8	2.8	**4.56**	**2.93**
mk0v1_133	584295	823365	3.3	6	10	0.9	1.9	**11.60**	**5.49**
mk0v1_147	584532	823182	0.1	6	10	5.7	6.7	**60.31**	**51.31**
mk0v1_156	584627	823162	5.1	6	10	1.5	2.5	**4.52**	**2.71**
mk0v1_160	585128	823069	1.5	6	10	5.7	6.7	**4.02**	**3.42**
mk0v1_172	585113	823352	5	6	10	2.7	3.7	**2.56**	**1.87**
mk0v1_173	585045	823386	5.4	6	10	1.8	2.8	**3.56**	**2.29**
mk0v1_174	584999	823448	0.8	6	10	3.1	4.1	**13.86**	**10.48**
mk0v1_178	584733	823819	6.5	6	10	1.8	2.8	**2.96**	**1.91**
mk0v1_186	585401	822975	2.1	6	10	4.1	5.1	**4.00**	**3.21**
mk0v1_190	585629	822579	7.9	6	10	0.9	1.9	**4.90**	**2.32**
mk0v1_394	584532	823182	0.1	6	10	5.7	6.7	**60.31**	**51.31**
mk0v1_397	584235	823654	9.9	6	10	1.6	2.6	**2.21**	**1.36**
mk0v1_398	584234	823562	8.2	6	10	1.2	2.2	**3.54**	**1.93**
mk0v1_399	584238	823475	6.7	6	10	2.2	3.2	**2.35**	**1.62**
mk0v1_400	584233	823375	2.4	6	10	1.6	2.6	**8.96**	**5.52**
mk0v1_401	584229	823270	1.1	6	10	5.8	6.8	**5.39**	**4.60**
mk0v1_410	584125	823985	3.4	6	10	1.7	2.7	**5.96**	**3.75**
mk0v1_411	584028	823957	7.7	6	10	1	2.0	**4.52**	**2.26**
mk0v1_427	584734	823263	1.7	6	10	5.7	6.7	**3.55**	**3.02**
nol1_312	584854	823616	2.9	6	10	3	4.0	**3.96**	**2.97**
nol1_313	584897	823542	2.4	6	10	5.5	6.5	**2.61**	**2.21**
nol1_317	583317	823657	3.1	6	10	3.6	4.6	**3.09**	**2.42**
nol1_318	583314	823684	4.8	6	10	3	4.0	**2.40**	**1.80**
nol1_320	583859	823518	1.7	6	10	2.75	3.8	**7.36**	**5.40**
nol1_322	584227	823317	3.9	6	10	2	3.0	**4.42**	**2.95**
nol1_328	584032	823997	10.9	6	10	0.3	1.3	**10.77**	**2.49**
nol1_329	584058	823959	10.6	6	10	0.9	1.9	**3.69**	**1.75**
nol1_332	584116	823992	6.5	6	10	0.9	1.9	**5.93**	**2.81**
nol1_333	584096	824006	8.4	6	10	1.2	2.2	**3.46**	**1.89**
nol1_334	584078	824021	7.6	6	10	3	4.0	**1.53**	**1.14**
nol1_335	584227	824022	4.9	6	10	0.7	1.7	**10.07**	**4.15**
nol1_338	584197	824031	5.7	6	10	1.5	2.5	**4.05**	**2.43**
nol1_340	584309	823725	10.6	6	10	0.8	1.8	**4.15**	**1.84**
nol1_343	584717	823874	4.5	6	10	5	6.0	**1.53**	**1.28**
nol1_344	584705	823845	5	6	10	1	2.0	**6.91**	**3.46**
nol2_345	585021	823396	4.8	6	10	1.5	2.5	**4.80**	**2.88**
nol2_346	585097	823436	2.7	6	10	1.8	2.8	**7.08**	**4.55**
nol2_347	585086	823403	2.3	6	10	1.8	2.8	**8.31**	**5.34**
nol2_348	585043	823356	8.1	6	10	1.5	2.5	**2.87**	**1.72**
nol2_349	585198	823317	4.2	6	10	2.2	3.2	**3.73**	**2.57**
nol2_350	585079	823242	3.4	6	10	3.3	4.3	**3.07**	**2.36**
nol2_351	585100	823222	2.7	6	10	4.5	5.5	**2.83**	**2.32**
nol2_352	585132	823182	5	6	10	3.6	4.6	**1.92**	**1.50**
nol2_353	585053	823073	3.4	6	10	3.3	4.3	**3.07**	**2.36**
nol2_356	584971	823050	0.8	6	10	3.6	4.6	**11.94**	**9.34**
nol2_357	584924	823035	3.5	6	10	3.6	4.6	**2.74**	**2.14**
nol2_358	584922	822994	3	6	10	3.6	4.6	**3.19**	**2.50**
nol2_359	585037	823019	3.1	6	10	2.5	3.5	**4.44**	**3.17**
nol2_361	585490	822885	2.6	6	10	3.6	4.6	**3.68**	**2.88**
nol2_362	585492	822960	2.9	6	10	6	7.0	**1.98**	**1.70**

Calculated FoS of Natural Peat Slopes for Croagh Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
nol2_363	585527	822979	2.1	6	10	4.8	5.8	**3.41**	**2.82**
nol2_364	585415	822677	3.4	6	10	1.8	2.8	**5.63**	**3.62**
nol2_366	584867	822629	1.1	6	10	3.6	4.6	**8.68**	**6.80**
nol2_236	585412	822802	4.6	6	10	2.5	3.5	**3.00**	**2.14**
nol2_239	585610	822634	6.5	6	10	2.2	3.2	**2.42**	**1.67**
nol2_240	585959	822635	4.1	6	10	4.9	5.9	**1.72**	**1.43**
nol2_241	585986	822660	3.3	6	10	4	5.0	**2.61**	**2.09**
nol2_242	586002	822633	2.9	6	10	5.5	6.5	**2.16**	**1.83**
nol2_243	586025	822621	2.6	6	10	5.5	6.5	**2.41**	**2.04**
nol2_244	586024	822646	3	6	10	3.7	4.7	**3.10**	**2.44**
nol2_245	586031	822667	3.3	6	10	3.7	4.7	**2.82**	**2.22**
nol2_246	586012	822666	4.6	6	10	3.8	4.8	**1.98**	**1.56**
nol2_250	585529	822943	2.2	6	10	4.5	5.5	**3.48**	**2.84**
nol2_251	585510	822942	1.8	6	10	5.2	6.2	**3.68**	**3.08**
nol2_252	585509	822929	3	6	10	4.1	5.1	**2.80**	**2.25**
nol2_253	585513	822912	3.6	6	10	3.4	4.4	**2.82**	**2.18**
nol2_254	585475	822930	2.9	6	10	3.6	4.6	**3.30**	**2.58**
eg2_189	583818	823444	7.6	6	10	2.1	3.1	**2.18**	**1.48**
eg2_190	583799	823431	4	6	10	4.1	5.1	**2.10**	**1.69**
eg2_201	583871	823287	2.2	6	10	2.7	3.7	**5.79**	**4.23**
eg2_204	584202	823287	1.9	6	10	5.5	6.5	**3.29**	**2.79**
eg2_205	584200	823339	3.1	6	10	1.9	2.9	**5.85**	**3.83**
eg2_206	584222	823303	2.3	6	10	2.7	3.7	**5.54**	**4.04**
eg2_207	584269	823306	4.3	6	10	2.1	3.1	**3.82**	**2.59**
eg2_208	584264	823336	8.6	6	10	2	3.0	**2.03**	**1.35**
eg2_209	584247	823325	5.7	6	10	1.9	2.9	**3.20**	**2.09**
eg2_210	584199	823318	1.2	6	10	2.5	3.5	**11.46**	**8.19**
eg2_212	584011	824106	5.4	6	10	2.1	3.1	**3.05**	**2.07**
eg2_213	583958	824105	3.4	6	10	2.5	3.5	**4.05**	**2.90**
eg2_215	583909	824085	2.3	6	10	2.9	3.9	**5.16**	**3.84**
eg2_217	583856	824075	2	6	10	3	4.0	**5.73**	**4.30**
eg2_218	583816	824066	3.3	6	10	1.9	2.9	**5.49**	**3.60**
eg2_223	583800	824066	2.5	6	10	2.9	3.9	**4.75**	**3.53**
eg2_227	583875	823957	10.8	6	10	1.1	2.1	**2.96**	**1.55**
eg2_234	584745	823816	7.6	6	10	1.2	2.2	**3.81**	**2.08**
eg2_235	584727	823829	7.4	6	10	2	3.0	**2.35**	**1.57**
T2	583789	823872	9	6	10	0.6	1.6	**6.47**	**2.43**
T4	584433	823809	2.9	6	10	2.4	3.4	**4.95**	**3.49**
T7	585063	823067	3.4	6	10	3.3	4.3	**3.07**	**2.36**
P40	584612	823926	8.3	6	10	0.3	1.3	**14.00**	**3.23**
P41	584521	823899	8.3	6	10	2.7	3.7	**1.56**	**1.14**
P42	584452	823830	6.3	6	10	2.3	3.3	**2.39**	**1.67**
P43	584374	823774	11.9	6	10	1.8	2.8	**1.65**	**1.06**
P44	584286	823815	9.8	6	10	0.6	1.6	**5.96**	**2.24**
P45	584234	823888	5.8	6	10	0.8	1.8	**7.46**	**3.32**
P47	584145	824040	11.9	6	10	1.7	2.7	**1.75**	**1.10**
P48	584052	824077	8.1	6	10	0.9	1.9	**4.78**	**2.26**
P56	583834	823908	11.7	6	10	0.3	1.3	**10.07**	**2.32**
P70	583795	823676	3.3	6	10	1.6	2.6	**6.53**	**4.02**
P71	583800	823576	6.2	6	10	0.9	1.9	**6.21**	**2.94**
P72	583832	823485	5	6	10	1.8	2.8	**3.84**	**2.47**
P83	584767	823792	4.3	6	10	1.7	2.7	**4.72**	**2.97**
P84	584785	823697	2.3	6	10	3.3	4.3	**4.53**	**3.48**
P85	584831	823608	3.2	6	10	2.3	3.3	**4.68**	**3.26**
P86	584873	823517	3.5	6	10	3.8	4.8	**2.59**	**2.05**
P87	584917	823427	2.5	6	10	2.8	3.8	**4.92**	**3.62**
P88	584987	823356	6.4	6	10	1.5	2.5	**3.61**	**2.17**
P89	585057	823285	3.1	6	10	1.6	2.6	**6.94**	**4.27**
P90	585127	823213	3.3	6	10	2.8	3.8	**3.73**	**2.75**
P91	585183	823131	0.7	6	10	3.8	4.8	**12.93**	**10.23**
P92	585237	823047	2.6	6	10	1.7	2.7	**7.79**	**4.90**
P93	585286	822960	5.3	6	10	1.5	2.5	**4.35**	**2.61**
P94	585332	822871	4.2	6	10	2	3.0	**4.11**	**2.74**
P95	585378	822782	6.8	6	10	2.2	3.2	**2.32**	**1.59**
P96	585424	822693	6.5	6	10	2.2	3.2	**2.42**	**1.67**
P97	585470	822605	9.5	6	10	0.9	1.9	**4.10**	**1.94**
P98	585517	822516	7	6	10	0.6	1.6	**8.27**	**3.10**
P99	585593	822458	11.8	6	10	0.2	1.2	**14.99**	**2.50**
P100	585636	822369	5.1	6	10	1.4	2.4	**4.84**	**2.82**
P101	585679	822278	6.7	6	10	2.3	3.3	**2.25**	**1.57**
P102	585673	822186	2.9	6	10	3.3	4.3	**3.60**	**2.76**
P103	585619	822102	1.7	6	10	2.5	3.5	**8.09**	**5.78**
P114	585936	822137	3.9	6	10	1.4	2.4	**6.32**	**3.68**
P115	585995	822057	2.9	6	10	1	2.0	**11.87**	**5.94**
P116	586050	821974	5.7	6	10	2.3	3.3	**2.64**	**1.84**
P119	586182	821732	4.9	6	10	1.4	2.4	**5.04**	**2.94**
P120	586198	821639	9.1	6	10	1.4	2.4	**2.74**	**1.60**
WP007	584205	823981	10.4	6	10	0.5	1.5	**6.76**	**2.25**
WP009	584727	823878	5.6	6	10	0.5	1.5	**12.36**	**4.12**
WP011	584874	823509	3.5	6	10	2.4	3.4	**4.10**	**2.90**
WP013	584002	823980	9.4	6	10	0.7	1.7	**5.32**	**2.19**
WP014	583940	823932	3.9	6	10	1	2.0	**8.84**	**4.42**
WP015	583814	823766	3	6	10	0.8	1.8	**14.35**	**6.38**
WP019	583741	823834	6.4	6	10	1	2.0	**5.42**	**2.71**
WP031	585821	822218	5.9	6	10	0.5	1.5	**11.74**	**3.91**
WP033	586127	821871	7	6	10	0.4	1.4	**12.40**	**3.54**
WP034	586177	821793	7.7	6	10	0.8	1.8	**5.65**	**2.51**
agec_16	585703	822331	5.4	6	10	0.6	1.6	**10.67**	**4.00**
agec_23	585678	822606	8.5	6	10	0.1	1.1	**41.04**	**3.73**
agec_24	585778	822606	3	6	10	0.3	1.3	**38.27**	**8.83**
agec_25	585878	822606	3.1	6	10	0.5	1.5	**22.22**	**7.41**
agec_26	585978	822606	8.5	6	10	0.1	1.1	**41.04**	**3.73**
agec_38	585594	822906	2.6	6	10	3.7	4.7	**3.58**	**2.82**
agec_81	586178	822615	5.7	6	10	2.1	3.1	**2.89**	**1.96**
agec_122	585365	822234	3.9	6	10	4.5	5.5	**1.96**	**1.61**
agec_130	584665	822434	6.2	6	10	2.7	3.7	**2.07**	**1.51**
agec_134	584665	822522	11	6	10	1.4	2.4	**2.29**	**1.33**
agec_365	585489	822211	0.9	6	10	3.8	4.8	**10.05**	**7.96**
agec_WP003	585180	822324	2.1	6	10	1.4	2.4	**11.70**	**6.83**
agec_WP004	585112	822350	5.7	6	10	1.9	2.9	**3.20**	**2.09**
agec_WP033	585478	822906	3.3	6	10	2.2	3.2	**4.75**	**3.26**
agec_WP042	585700	822608	4.7	6	10	0.1	1.1	**73.47**	**6.68**
agec_WP043	585773	822609	4.5	6	10	3.2	4.2	**2.40**	**1.83**
agec_WP044	585880	822621	6.1	6	10	2.9	3.9	**1.96**	**1.46**
agec_WP045	585969	822582	5.9	6	10	3.8	4.8	**1.54**	**1.22**
agec_WP046	586077	822627	3.1	6	10	2.7	3.7	**4.12**	**3.00**
agec_WP047	586066	822558	2.3	6	10	4.8	5.8	**3.12**	**2.58**
agec_WP052	583920	824106	2.9	6	10	1.9	2.9	**6.25**	**4.09**
agec_WP054a	583814	824109	3.3	6	10	1.9	2.9	**5.49**	**3.60**
agec_WP061	583995	823988	11.2	6	10	0.5	1.5	**6.30**	**2.10**
agec_WP062	583844	823909	9.4	6	10	0.9	1.9	**4.14**	**1.96**
TP14A	585478	822902	3.3	6	10	2.1	3.1	**4.97**	**3.37**
TP16A	585793	822604	3.7	6	10	1.3	2.3	**7.17**	**4.05**
TP12A	584963	823032	1.1	6	10	2.5	3.5	**12.50**	**8.93**
TP11A	585147	823241	6.9	6	10	1.3	2.3	**3.87**	**2.19**
TP9A	585085	823414	1.9	6	10	1.7	2.7	**10.65**	**6.71**
TP17A	584623	823207	3	6	10	2.2	3.2	**5.22**	**3.59**
TP8A	584858	823499	1.8	6	10	4	5.0	**4.78**	**3.82**
TP18A	584564	823907	9.6	6	10	0.3	1.3	**12.16**	**2.81**
TP22A	584238	823501	5.5	6	10	3.2	4.2	**1.97**	**1.50**

Calculated FoS of Natural Peat Slopes for Croagh Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
TP10A	584076	824034	8.8	6	10	0.4	1.4	**9.92**	**2.83**
TP3A	583836	823526	6.1	6	10	1.1	2.1	**5.16**	**2.70**
TP21A	586026	821965	4.3	6	10	2.9	3.9	**2.77**	**2.06**
TP15A	586587	821278	9.9	6	10	1	2.0	**3.54**	**1.77**
WP006b	583643	823324	3.7	6	10	2.8	3.8	**3.33**	**2.45**
WP007b	583645	823315	3.7	6	10	2	3.0	**4.66**	**3.11**
WP008b	583652	823318	6.5	6	10	1.9	2.9	**2.81**	**1.84**
WP009b	583844	824110	1.7	6	10	2.8	3.8	**7.23**	**5.32**
WP010b	583853	824113	2.6	6	10	1.8	2.8	**7.36**	**4.73**
WP011b	583849	824107	1	6	10	2.7	3.7	**12.73**	**9.29**
WP012b	584866	823560	2.6	6	10	3.7	4.7	**3.58**	**2.82**
WP013b	584881	823563	2.5	6	10	3.8	4.8	**3.62**	**2.87**
WP014b	584882	823563	2.5	6	10	3.7	4.7	**3.72**	**2.93**
WP017b	584637	823196	3.1	6	10	2	3.0	**5.56**	**3.70**
WP018b	584648	823212	3.3	6	10	2.1	3.1	**4.97**	**3.37**
WP020b	586160	822535	1.2	6	10	2.1	3.1	**13.65**	**9.24**
WP021b	586161	822600	2.1	6	10	2.6	3.6	**6.30**	**4.55**
WP022b	586156	822578	1.2	6	10	3.5	4.5	**8.19**	**6.37**
WP023b	586138	822582	2.1	6	10	4.5	5.5	**3.64**	**2.98**
WP024b	583324	823640	4.6	6	10	2.1	3.1	**3.57**	**2.42**
WP025b	583331	823648	3	6	10	2.2	3.2	**5.22**	**3.59**
WP026b	583314	823652	4.5	6	10	2	3.0	**3.84**	**2.56**
WP027b	583327	823624	4.7	6	10	1.8	2.8	**4.08**	**2.62**
WP028b	583327	823624	5	6	10	2.1	3.1	**3.29**	**2.23**
WP029b	584275	823358	3.3	6	10	0.7	1.7	**14.91**	**6.14**
WP030b	584835	823638	2.5	6	10	1.7	2.7	**8.10**	**5.10**
WP031b	584699	822496	7.4	6	10	0.8	1.8	**5.87**	**2.61**
WP032b	584680	822475	6.9	6	10	0.9	1.9	**5.59**	**2.65**
WP033b	584665	822501	8.6	6	10	1	2.0	**4.06**	**2.03**
WP034b	584668	822488	11.7	6	10	0.8	1.8	**3.78**	**1.68**
WP035b	584674	822476	10.5	6	10	0.8	1.8	**4.19**	**1.86**
CM379	583829	823299	3.5	6	10	2.4	3.4	**4.10**	**2.90**
CM380	583801	823309	2	6	10	2.4	3.4	**7.17**	**5.06**
CM381	583776	823318	1.3	6	10	2.5	3.5	**10.58**	**7.56**
CM390	583640	823333	4.8	6	10	2.1	3.1	**3.43**	**2.32**
CM391	583659	823307	4.2	6	10	1.2	2.2	**6.85**	**3.73**
CM392	583674	823329	2.2	6	10	1.8	2.8	**8.69**	**5.59**
CM393	583669	823298	4.2	6	10	1	2.0	**8.21**	**4.11**
CM394	583674	823256	1.3	6	10	2	3.0	**13.23**	**8.82**
CM397	583727	823301	5.1	6	10	0.6	1.6	**11.29**	**4.24**
CM398	583747	823283	7.9	6	10	1	2.0	**4.41**	**2.20**
CM399	583755	823260	5.6	6	10	0.2	1.2	**30.89**	**5.15**
CM400	583781	823255	6.4	6	10	0.5	1.5	**10.83**	**3.61**
CM401	583807	823248	No peat recorded at location						
CM422	585955	822586	7.2	6	10	2.3	3.3	**2.10**	**1.46**
CM423	585916	822611	6.7	6	10	1.1	2.1	**4.71**	**2.47**
CM424	585872	822609	8.1	6	10	1	2.0	**4.30**	**2.15**
CM425	585828	822605	3.3	6	10	1.6	2.6	**6.53**	**4.02**
CM426	585777	822597	10.4	6	10	1.1	2.1	**3.07**	**1.61**
CM427	585731	822594	8	6	10	1.5	2.5	**2.90**	**1.74**
CM429	585647	822609	6.5	6	10	1.5	2.5	**3.56**	**2.13**
CM430	585603	822638	7.1	6	10	1.5	2.5	**3.26**	**1.96**
PP	584745	822555	7.1	6	10	2.5	3.5	**1.96**	**1.40**
PP10	583700	823628	4.9	6	10	1.6	2.6	**4.41**	**2.71**
PP11	583646	823639	5.7	6	10	1.1	2.1	**5.52**	**2.89**
PP12	583526	823648	4.2	6	10	1	2.0	**8.21**	**4.11**
PP13	583490	823639	2.6	6	10	2.2	3.2	**6.02**	**4.14**
PP14	583387	823633	3.8	6	10	2.4	3.4	**3.78**	**2.67**
PP15	583358	823622	4.6	6	10	2.7	3.7	**2.78**	**2.03**
PP4	584762	822581	12.2	6	10	1	2.0	**2.90**	**1.45**
PP5	584796	822595	4	6	10	2	3.0	**4.31**	**2.87**
PP6	584906	822595	2.7	6	10	2.85	3.9	**4.47**	**3.31**
PP7	584986	822621	4.7	6	10	2	3.0	**3.67**	**2.45**
PP9	583754	823599	4.6	6	10	1.5	2.5	**5.00**	**3.00**
T10	584676	822493	8.6	6	10	1.5	2.5	**2.71**	**1.62**
WP001c	583746	823619	5.3	6	10	1.6	2.6	**4.08**	**2.51**
WP002c	583724	823633	4.4	6	10	0.8	1.8	**9.80**	**4.36**
WP003c	583691	823605	3.3	6	10	1.4	2.4	**7.46**	**4.35**
WP004c	583660	823627	4.9	6	10	1.2	2.2	**5.88**	**3.20**
WP005c	583638	823638	6.2	6	10	0.9	1.9	**6.21**	**2.94**
WP006c	586876	821154	7.6	6	10	0.9	1.9	**5.09**	**2.41**
WP009c	586757	821108	13.1	6	10	0.9	1.9	**3.02**	**1.43**
WP010c	586733	821124	15.1	6	10	0.7	1.7	**3.41**	**1.40**
WP011c	586684	821141	10	6	10	1.4	2.4	**2.51**	**1.46**
WP013c	586609	821257	9.6	6	10	0.9	1.9	**4.05**	**1.92**
WP018c	585449	822222	3.8	6	10	2.6	3.6	**3.49**	**2.52**
WP019c	585425	822227	5.3	6	10	1.6	2.6	**4.08**	**2.51**
WP020c	585374	822269	6.9	6	10	1.8	2.8	**2.79**	**1.80**
WP021c	585326	822294	5.2	6	10	1.9	2.9	**3.50**	**2.29**
WP022c	585170	822334	5.3	6	10	1.5	2.5	**4.35**	**2.61**
WP023c	585132	822369	8	6	10	1	2.0	**4.35**	**2.18**
WP024c	585118	822404	3.8	6	10	1.3	2.3	**6.98**	**3.94**
WP025c	585115	822410	13.9	6	10	0.6	1.6	**4.29**	**1.61**
WP026c	585042	822507	8.5	6	10	0.8	1.8	**5.13**	**2.28**
WP027c	585038	822585	3.3	6	10	1.6	2.6	**6.53**	**4.02**
mk0v3_562	584102	823120	12.8	6	10	1.2	2.2	**2.31**	**1.26**
mk0v3_563	584124	823131	8.2	6	10	1	2.0	**4.25**	**2.13**
mk0v3_564	584071	823091	3.9	6	10	3.5	4.5	**2.53**	**1.96**
mk0v3_565	584043	823102	3.3	6	10	2.7	3.7	**3.87**	**2.82**
mk0v3_566	584012	823114	2.8	6	10	2.8	3.8	**4.39**	**3.24**
mk0v3_567	583984	823121	2.4	6	10	3	4.0	**4.78**	**3.59**
mk0v3_568	583944	823138	5.8	6	10	3.4	4.4	**1.76**	**1.36**
mk0v3_569	583909	823151	6.2	6	10	3.4	4.4	**1.64**	**1.27**
							Minimum =	**1.53**	**1.05**
							Maximum =	**73.47**	**51.31**
							Average =	**6.97**	**3.73**

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3

(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa.

(3) Slope inclination (β) based on site readings and site contour plans.

(4) A lower bound undrained shear strength, cu for the peat of 6kPa was selected for the assessment. It should be noted that a cu of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength.

(5) Peat depths based on probes carried out by FT, Coillte, HES and MKO.

(6) For load conditions see report text.

Calculated FoS of Natural Peat Slopes for Croagh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	100% Water to height of Peat	Depth of In situ Peat	Friction Angle	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	(m)	ø' (deg)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
AT1	3	4	10.0	10.0	2.2	2.2	25	3.2	**3.48**	**5.17**
AT2	2	4	10.0	10.0	2.8	2.8	25	3.8	**4.10**	**6.53**
AT3	2	4	10.0	10.0	2.8	2.8	25	3.8	**4.10**	**6.53**
AT4	12	4	10.0	10.0	1.0	1	25	2.0	**1.97**	**2.08**
AT5	2	4	10.0	10.0	1.3	1.3	25	2.3	**8.82**	**10.79**
AT6	2	4	10.0	10.0	2.4	2.4	25	3.4	**4.78**	**7.30**
AT7	1.1	4	10.0	10.0	2.8	2.8	25	3.8	**7.44**	**11.88**
AT8	3.7	4	10.0	10.0	3.9	3.9	25	4.9	**1.59**	**2.74**
AT9	3	4	10.0	10.0	4.5	4.54	25	5.5	**1.69**	**2.99**
AT10	6	4	10.0	10.0	1.0	1	25	2.0	**3.85**	**4.14**
Amet	2.3	4	10.0	10.0	0.6	0.6	25	1.6	**16.63**	**13.49**
Amet - SS	1.2	4	10.0	10.0	8.2	8.2	25	9.2	**2.33**	**4.50**
AT1 - SS	4.5	4	10.0	10.0	1.8	1.8	25	2.8	**2.84**	**3.94**
AT2 - SS	2.5	4	10.0	10.0	2.0	2	25	3.0	**4.59**	**6.62**
AT5 - SS	5.6	4	10.0	10.0	1.3	1.3	25	2.3	**3.17**	**3.86**
AT9 - SS	3	4	10.0	10.0	5.6	5.6	25	6.6	**1.37**	**2.51**
A54	9.8	4	10.0	10.0	0.2	0.2	25	1.2	**11.92**	**4.24**
A56	6.1	4	10.0	10.0	0.7	0.7	25	1.7	**5.41**	**4.79**
A57	1.8	4	10.0	10.0	0.3	0.3	25	1.3	**42.47**	**21.21**
A58	9.8	4	10.0	10.0	0.4	0.4	25	1.4	**5.96**	**3.63**
A59	7	4	10.0	10.0	0.2	0.2	25	1.2	**16.53**	**5.92**
A60	10	4	10.0	10.0	0.6	0.6	25	1.6	**3.90**	**3.11**
A61	10	4	10.0	10.0	0.9	0.9	25	1.9	**2.60**	**2.62**
A62	4.7	4	10.0	10.0	1.3	1.3	25	2.3	**3.77**	**4.60**
A63	7.2	4	10.0	10.0	1.4	1.4	25	2.4	**2.30**	**2.88**
A64	7	4	10.0	10.0	0.9	0.9	25	1.9	**3.67**	**3.74**
A82	0.4	4	10.0	10.0	1.7	1.7	25	2.7	**33.70**	**45.96**
A91	4.2	4	10.0	10.0	1.3	1.3	25	2.3	**4.21**	**5.14**
A93	4.2	4	10.0	10.0	0.6	0.6	25	1.6	**9.13**	**7.39**
A94	10	4	10.0	10.0	0.2	0.2	25	1.2	**11.70**	**4.15**
A96	8.7	4	10.0	10.0	0.3	0.3	25	1.3	**8.92**	**4.40**
A98	7.5	4	10.0	10.0	0.9	0.9	25	1.9	**3.43**	**3.49**
A112	4.1	4	10.0	10.0	1.7	1.7	25	2.7	**3.30**	**4.49**
A113	1.9	4	10.0	10.0	2.6	2.6	25	3.6	**4.64**	**7.26**
A114	3.2	4	10.0	10.0	1.9	1.9	25	2.9	**3.78**	**5.35**
A118	3.7	4	10.0	10.0	2.6	2.6	25	3.6	**2.39**	**3.73**
A119	1.8	4	10.0	10.0	2.7	2.7	25	3.7	**4.72**	**7.45**
A120	3	4	10.0	10.0	2.9	2.9	25	3.9	**2.64**	**4.24**
A135	14.6	4	10.0	10.0	0.2	0.2	25	1.2	**8.20**	**2.86**
A136	9.6	4	10.0	10.0	0.9	0.9	25	1.9	**2.70**	**2.73**
A146	3	4	10.0	10.0	3.2	3.2	25	4.2	**2.39**	**3.94**
A166	0.2	4	10.0	10.0	2.7	2.7	25	3.7	**42.44**	**67.08**
A167	0.6	4	10.0	10.0	4.5	4.5	25	5.5	**8.49**	**15.04**
A168	2.1	4	10.0	10.0	5.0	5	25	6.0	**2.18**	**3.94**
A169	2.5	4	10.0	10.0	2.2	2.2	25	3.2	**4.17**	**6.21**
A170	1.1	4	10.0	10.0	2.6	2.6	25	3.6	**8.02**	**12.53**
WP007	9.1	4	10.0	10.0	1.0	1	25	2.0	**2.56**	**2.74**
WP008	6.8	4	10.0	10.0	1.1	1.1	25	2.1	**3.09**	**3.48**
WP010	2.3	4	10.0	10.0	2.8	2.8	25	3.8	**3.56**	**5.68**
WP011	7.6	4	10.0	10.0	1.9	1.9	25	2.9	**1.61**	**2.26**
WP012	7.6	4	10.0	10.0	1.4	1.4	25	2.4	**2.18**	**2.73**
WP013	5.2	4	10.0	10.0	1.8	1.8	25	2.8	**2.46**	**3.41**
WP014	5.7	4	10.0	10.0	0.5	0.5	25	1.5	**8.09**	**5.81**
WP017	12	4	10.0	10.0	0.4	0.4	25	1.4	**4.92**	**2.97**
WP018	6	4	10.0	10.0	0.7	0.7	25	1.7	**5.50**	**4.87**
WP022	7.1	4	10.0	10.0	1.8	1.8	25	2.8	**1.81**	**2.50**
WP023	5.6	4	10.0	10.0	1.0	1	25	2.0	**4.12**	**4.44**
WP024	4.1	4	10.0	10.0	2.6	2.6	25	3.6	**2.16**	**3.37**
WP025	4.6	4	10.0	10.0	0.8	0.8	25	1.8	**6.25**	**6.00**
WP027	4.7	4	10.0	10.0	2.2	2.2	25	3.2	**2.23**	**3.30**
mk0v1_79	2.1	4	10.0	10.0	3.0	3	25	4.0	**3.64**	**5.91**
mk0v1_93	2.9	4	10.0	10.0	3.8	3.8	25	4.8	**2.08**	**3.57**
mk0v1_112	4.6	4	10.0	10.0	2.2	2.2	25	3.2	**2.27**	**3.37**
mk0v1_114	4.6	4	10.0	10.0	1.9	1.9	25	2.9	**2.63**	**3.72**
mk0v1_115	5.5	4	10.0	10.0	2.0	2	25	3.0	**2.10**	**3.01**
mk0v1_116	7.4	4	10.0	10.0	1.6	1.6	25	2.6	**1.96**	**2.59**
mk0v1_117	6.7	4	10.0	10.0	1.6	1.6	25	2.6	**2.16**	**2.85**
mk0v1_129	12.1	4	10.0	10.0	1.8	1.8	25	2.8	**1.08**	**1.47**
mk0v1_130	4.2	4	10.0	10.0	1.8	1.8	25	2.8	**3.04**	**4.22**
mk0v1_133	3.3	4	10.0	10.0	0.9	0.9	25	1.9	**7.73**	**7.92**
mk0v1_147	0.1	4	10.0	10.0	5.7	5.7	25	6.7	**40.21**	**74.08**
mk0v1_156	5.1	4	10.0	10.0	1.5	1.5	25	2.5	**3.01**	**3.90**
mk0v1_160	1.5	4	10.0	10.0	5.7	5.7	25	6.7	**2.68**	**4.94**
mk0v1_172	5	4	10.0	10.0	2.7	2.7	25	3.7	**1.71**	**2.69**
mk0v1_173	5.4	4	10.0	10.0	1.8	1.8	25	2.8	**2.37**	**3.29**
mk0v1_174	0.8	4	10.0	10.0	3.1	3.1	25	4.1	**9.24**	**15.13**
mk0v1_178	6.5	4	10.0	10.0	1.8	1.8	25	2.8	**1.98**	**2.73**
mk0v1_186	2.1	4	10.0	10.0	4.1	4.1	25	5.1	**2.66**	**4.64**
mk0v1_190	7.9	4	10.0	10.0	0.9	0.9	25	1.9	**3.26**	**3.32**
mk0v1_394	0.1	4	10.0	10.0	5.7	5.7	25	6.7	**40.21**	**74.08**
mk0v1_397	9.9	4	10.0	10.0	1.6	1.6	25	2.6	**1.48**	**1.94**
mk0v1_398	8.2	4	10.0	10.0	1.2	1.2	25	2.2	**2.36**	**2.76**
mk0v1_399	6.7	4	10.0	10.0	2.2	2.2	25	3.2	**1.57**	**2.32**
mk0v1_400	2.4	4	10.0	10.0	1.6	1.6	25	2.6	**5.98**	**7.96**
mk0v1_401	1.1	4	10.0	10.0	5.8	5.8	25	6.8	**3.59**	**6.64**
mk0v1_410	3.4	4	10.0	10.0	1.7	1.7	25	2.7	**3.97**	**5.41**
mk0v1_411	7.7	4	10.0	10.0	1.0	1	25	2.0	**3.01**	**3.23**
mk0v1_427	1.7	4	10.0	10.0	5.7	5.7	25	6.7	**2.37**	**4.36**
nol1_312	2.9	4	10.0	10.0	3.0	3	25	4.0	**2.64**	**4.28**
nol1_313	2.4	4	10.0	10.0	5.5	5.5	25	6.5	**1.74**	**3.18**
nol1_317	3.1	4	10.0	10.0	3.6	3.6	25	4.6	**2.06**	**3.48**
nol1_318	4.8	4	10.0	10.0	3.0	3	25	4.0	**1.60**	**2.59**
nol1_320	1.7	4	10.0	10.0	2.8	2.75	25	3.8	**4.91**	**7.79**
nol1_322	3.9	4	10.0	10.0	2.0	2	25	3.0	**2.95**	**4.24**
nol1_328	10.9	4	10.0	10.0	0.3	0.3	25	1.3	**7.18**	**3.52**
nol1_329	10.6	4	10.0	10.0	0.9	0.9	25	1.9	**2.46**	**2.48**
nol1_332	6.5	4	10.0	10.0	0.9	0.9	25	1.9	**3.95**	**4.03**
nol1_333	8.4	4	10.0	10.0	1.2	1.2	25	2.2	**2.31**	**2.69**
nol1_334	7.6	4	10.0	10.0	3.0	3	25	4.0	**1.02**	**1.64**
nol1_335	4.9	4	10.0	10.0	0.7	0.7	25	1.7	**6.71**	**5.96**
nol1_338	5.7	4	10.0	10.0	1.5	1.5	25	2.5	**2.70**	**3.49**
nol1_340	10.6	4	10.0	10.0	0.8	0.8	25	1.8	**2.77**	**2.61**
nol1_343	4.5	4	10.0	10.0	5.0	5	25	6.0	**1.02**	**1.84**
nol1_344	5	4	10.0	10.0	1.0	1	25	2.0	**4.61**	**4.97**
nol2_345	4.8	4	10.0	10.0	1.5	1.5	25	2.5	**3.20**	**4.14**
nol2_346	2.7	4	10.0	10.0	1.8	1.8	25	2.8	**4.72**	**6.57**
nol2_347	2.3	4	10.0	10.0	1.8	1.8	25	2.8	**5.54**	**7.71**
nol2_348	8.1	4	10.0	10.0	1.5	1.5	25	2.5	**1.91**	**2.46**
nol2_349	4.2	4	10.0	10.0	2.2	2.2	25	3.2	**2.49**	**3.70**
nol2_350	3.4	4	10.0	10.0	3.3	3.3	25	4.3	**2.05**	**3.40**
nol2_351	2.7	4	10.0	10.0	4.5	4.5	25	5.5	**1.89**	**3.34**
nol2_352	3.2	4	10.0	10.0	3.6	3.6	25	4.6	**1.99**	**3.37**
nol2_353	3.4	4	10.0	10.0	3.3	3.3	25	4.3	**2.05**	**3.40**
nol2_356	0.8	4	10.0	10.0	3.6	3.6	25	4.6	**7.96**	**13.49**
nol2_357	3.5	4	10.0	10.0	3.6	3.6	25	4.6	**1.82**	**3.08**
nol2_358	3	4	10.0	10.0	3.6	3.6	25	4.6	**2.13**	**3.60**
nol2_359	3.1	4	10.0	10.0	2.5	2.5	25	3.5	**2.96**	**4.58**
nol2_361	2.6	4	10.0	10.0	3.6	3.6	25	4.6	**2.45**	**4.15**
nol2_362	2.9	4	10.0	10.0	6.0	6	25	7.0	**1.32**	**2.45**

Calculated FoS of Natural Peat Slopes for Croagh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	100% Water to height of Peat	Depth of In situ Peat	Friction Angle	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m³)	γ_w (kN/m³)	(m)	(m)	ø' (deg)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
nol2_363	2.1	4	10.0	10.0	4.8	4.8	25	5.8	**2.28**	**4.08**
nol2_364	3.4	4	10.0	10.0	1.8	1.8	25	2.8	**3.75**	**5.22**
nol2_366	1.1	4	10.0	10.0	3.6	3.6	25	4.6	**5.79**	**9.81**
nol2_236	4.6	4	10.0	10.0	2.5	2.5	25	3.5	**2.00**	**3.09**
nol2_239	6.5	4	10.0	10.0	2.2	2.2	25	3.2	**1.62**	**2.39**
nol2_240	4.1	4	10.0	10.0	4.9	4.9	25	5.9	**1.14**	**2.05**
nol2_241	3.3	4	10.0	10.0	4.0	4	25	5.0	**1.74**	**3.01**
nol2_242	2.9	4	10.0	10.0	5.5	5.5	25	6.5	**1.44**	**2.63**
nol2_243	2.6	4	10.0	10.0	5.5	5.5	25	6.5	**1.60**	**2.94**
nol2_244	3	4	10.0	10.0	3.7	3.7	25	4.7	**2.07**	**3.52**
nol2_245	3.3	4	10.0	10.0	3.7	3.7	25	4.7	**1.88**	**3.20**
nol2_246	4.6	4	10.0	10.0	3.8	3.8	25	4.8	**1.32**	**2.25**
nol2_250	2.2	4	10.0	10.0	4.5	4.5	25	5.5	**2.32**	**4.10**
nol2_251	1.8	4	10.0	10.0	5.2	5.2	25	6.2	**2.45**	**4.45**
nol2_252	3	4	10.0	10.0	4.1	4.1	25	5.1	**1.87**	**3.25**
nol2_253	3.6	4	10.0	10.0	3.4	3.4	25	4.4	**1.88**	**3.14**
nol2_254	2.9	4	10.0	10.0	3.6	3.6	25	4.6	**2.20**	**3.72**
eg2_189	7.6	4	10.0	10.0	2.1	2.1	25	3.1	**1.45**	**2.11**
eg2_190	4	4	10.0	10.0	4.1	4.1	25	5.1	**1.40**	**2.43**
eg2_201	2.2	4	10.0	10.0	2.7	2.7	25	3.7	**3.86**	**6.10**
eg2_204	1.9	4	10.0	10.0	5.5	5.5	25	6.5	**2.19**	**4.02**
eg2_205	3.1	4	10.0	10.0	1.9	1.9	25	2.9	**3.90**	**5.52**
eg2_206	2.3	4	10.0	10.0	2.7	2.7	25	3.7	**3.69**	**5.83**
eg2_207	4.3	4	10.0	10.0	2.1	2.1	25	3.1	**2.55**	**3.73**
eg2_208	8.6	4	10.0	10.0	2.0	2	25	3.0	**1.35**	**1.93**
eg2_209	5.7	4	10.0	10.0	1.9	1.9	25	2.9	**2.13**	**3.01**
eg2_210	1.2	4	10.0	10.0	2.5	2.5	25	3.5	**7.64**	**11.82**
eg2_212	5.4	4	10.0	10.0	2.1	2.1	25	3.1	**2.03**	**2.97**
eg2_213	3.4	4	10.0	10.0	2.5	2.5	25	3.5	**2.70**	**4.17**
eg2_215	2.3	4	10.0	10.0	2.9	2.9	25	3.9	**3.44**	**5.53**
eg2_217	2	4	10.0	10.0	3.0	3	25	4.0	**3.82**	**6.21**
eg2_218	3.3	4	10.0	10.0	1.9	1.9	25	2.9	**3.66**	**5.19**
eg2_223	2.5	4	10.0	10.0	2.9	2.9	25	3.9	**3.17**	**5.09**
eg2_227	10.8	4	10.0	10.0	1.1	1.1	25	2.1	**1.98**	**2.20**
eg2_234	7.6	4	10.0	10.0	1.2	1.2	25	2.2	**2.54**	**2.98**
eg2_235	7.4	4	10.0	10.0	2.0	2	25	3.0	**1.57**	**2.24**
T2	9	4	10.0	10.0	0.6	0.6	25	1.6	**4.31**	**3.46**
T4	2.9	4	10.0	10.0	2.4	2.4	25	3.4	**3.30**	**5.04**
T7	3.4	4	10.0	10.0	3.3	3.3	25	4.3	**2.05**	**3.40**
P40	8.3	4	10.0	10.0	0.3	0.3	25	1.3	**9.33**	**4.61**
P41	8.3	4	10.0	10.0	2.7	2.7	25	3.7	**1.04**	**1.62**
P42	6.3	4	10.0	10.0	2.3	2.3	25	3.3	**1.59**	**2.39**
P43	11.9	4	10.0	10.0	1.8	1.8	25	2.8	**1.10**	**1.50**
P44	9.8	4	10.0	10.0	0.6	0.6	25	1.6	**3.97**	**3.18**
P45	5.8	4	10.0	10.0	0.8	0.8	25	1.8	**4.97**	**4.76**
P47	11.9	4	10.0	10.0	1.7	1.7	25	2.7	**1.17**	**1.55**
P48	8.1	4	10.0	10.0	0.9	0.9	25	1.9	**3.19**	**3.23**
P56	11.7	4	10.0	10.0	0.3	0.3	25	1.3	**6.71**	**3.28**
P70	3.3	4	10.0	10.0	1.6	1.6	25	2.6	**4.35**	**5.79**
P71	6.2	4	10.0	10.0	0.9	0.9	25	1.9	**4.14**	**4.22**
P72	5	4	10.0	10.0	1.8	1.8	25	2.8	**2.56**	**3.55**
P83	4.3	4	10.0	10.0	1.7	1.7	25	2.7	**3.15**	**4.28**
P84	2.3	4	10.0	10.0	3.3	3.3	25	4.3	**3.02**	**5.02**
P85	3.2	4	10.0	10.0	2.3	2.3	25	3.3	**3.12**	**4.70**
P86	3.5	4	10.0	10.0	3.8	3.8	25	4.8	**1.73**	**2.96**
P87	2.5	4	10.0	10.0	2.8	2.8	25	3.8	**3.28**	**5.23**
P88	6.4	4	10.0	10.0	1.5	1.5	25	2.5	**2.41**	**3.11**
P89	3.1	4	10.0	10.0	1.6	1.6	25	2.6	**4.63**	**6.16**
P90	3.3	4	10.0	10.0	2.8	2.8	25	3.8	**2.49**	**3.96**
P91	0.7	4	10.0	10.0	3.8	3.8	25	4.8	**8.62**	**14.77**
P92	2.6	4	10.0	10.0	1.7	1.7	25	2.7	**5.19**	**7.07**
P93	5.3	4	10.0	10.0	1.5	1.5	25	2.5	**2.90**	**3.75**
P94	4.2	4	10.0	10.0	2.0	2	25	3.0	**2.74**	**3.94**
P95	6.8	4	10.0	10.0	2.2	2.2	25	3.2	**1.55**	**2.29**
P96	6.5	4	10.0	10.0	2.2	2.2	25	3.2	**1.62**	**2.39**
P97	9.5	4	10.0	10.0	0.9	0.9	25	1.9	**2.73**	**2.76**
P98	7	4	10.0	10.0	0.6	0.6	25	1.6	**5.51**	**4.44**
P99	11.8	4	10.0	10.0	0.2	0.2	25	1.2	**9.99**	**3.53**
P100	5.1	4	10.0	10.0	1.4	1.4	25	2.4	**3.23**	**4.06**
P101	6.7	4	10.0	10.0	2.3	2.3	25	3.3	**1.50**	**2.25**
P102	2.9	4	10.0	10.0	3.3	3.3	25	4.3	**2.40**	**3.98**
P103	1.7	4	10.0	10.0	2.5	2.5	25	3.5	**5.40**	**8.34**
P114	3.9	4	10.0	10.0	1.4	1.4	25	2.4	**4.21**	**5.31**
P115	2.9	4	10.0	10.0	1.0	1	25	2.0	**7.92**	**8.56**
P116	5.7	4	10.0	10.0	2.3	2.3	25	3.3	**1.76**	**2.64**
P119	4.9	4	10.0	10.0	1.4	1.4	25	2.4	**3.36**	**4.22**
P120	9.1	4	10.0	10.0	1.4	1.4	25	2.4	**1.83**	**2.28**
WP007	10.4	4	10.0	10.0	0.5	0.5	25	1.5	**4.51**	**3.20**
WP009	5.6	4	10.0	10.0	0.5	0.5	25	1.5	**8.24**	**5.92**
WP011	3.5	4	10.0	10.0	2.4	2.4	25	3.4	**2.74**	**4.17**
WP013	9.4	4	10.0	10.0	0.7	0.7	25	1.7	**3.55**	**3.12**
WP014	3.9	4	10.0	10.0	1.0	1	25	2.0	**5.89**	**6.37**
WP015	3	4	10.0	10.0	0.8	0.8	25	1.8	**9.57**	**9.20**
WP019	6.4	4	10.0	10.0	1.0	1	25	2.0	**3.61**	**3.88**
WP031	5.9	4	10.0	10.0	0.5	0.5	25	1.5	**7.82**	**5.62**
WP033	7	4	10.0	10.0	0.4	0.4	25	1.4	**8.27**	**5.07**
WP034	7.7	4	10.0	10.0	0.8	0.8	25	1.8	**3.77**	**3.59**
agec_16	5.4	4	10.0	10.0	0.6	0.6	25	1.6	**7.12**	**5.75**
agec_23	8.5	4	10.0	10.0	0.1	0.1	25	1.1	**27.36**	**5.32**
agec_24	3	4	10.0	10.0	0.3	0.3	25	1.3	**25.51**	**12.73**
agec_25	3.1	4	10.0	10.0	0.5	0.5	25	1.5	**14.81**	**10.68**
agec_26	8.5	4	10.0	10.0	0.1	0.1	25	1.1	**27.36**	**5.32**
agec_38	2.6	4	10.0	10.0	3.7	3.7	25	4.7	**2.39**	**4.06**
agec_81	5.7	4	10.0	10.0	2.1	2.1	25	3.1	**1.93**	**2.81**
agec_122	3.9	4	10.0	10.0	4.5	4.5	25	5.5	**1.31**	**2.32**
agec_130	6.2	4	10.0	10.0	2.7	2.7	25	3.7	**1.38**	**2.17**
agec_134	11	4	10.0	10.0	1.4	1.4	25	2.4	**1.53**	**1.89**
agec_365	0.9	4	10.0	10.0	3.8	3.8	25	4.8	**6.70**	**11.49**
agec_WP003	2.1	4	10.0	10.0	1.4	1.4	25	2.4	**7.80**	**9.85**
agec_WP004	5.7	4	10.0	10.0	1.9	1.9	25	2.9	**2.13**	**3.01**
agec_WP033	3.3	4	10.0	10.0	2.2	2.2	25	3.2	**3.16**	**4.70**
agec_WP042	4.7	4	10.0	10.0	0.1	0.1	25	1.1	**48.98**	**9.61**
agec_WP043	4.5	4	10.0	10.0	3.2	3.2	25	4.2	**1.60**	**2.63**
agec_WP044	6.1	4	10.0	10.0	2.9	2.9	25	3.9	**1.31**	**2.09**
agec_WP045	5.9	4	10.0	10.0	3.8	3.8	25	4.8	**1.03**	**1.76**
agec_WP046	3.1	4	10.0	10.0	2.7	2.7	25	3.7	**2.74**	**4.33**
agec_WP047	2.3	4	10.0	10.0	4.8	4.8	25	5.8	**2.08**	**3.72**
agec_WP052	2.9	4	10.0	10.0	1.9	1.9	25	2.9	**4.17**	**5.90**
agec_WP054a	3.3	4	10.0	10.0	1.9	1.9	25	2.9	**3.66**	**5.19**
agec_WP061	11.2	4	10.0	10.0	0.5	0.5	25	1.5	**4.20**	**2.97**
agec_WP062	9.4	4	10.0	10.0	0.9	0.9	25	1.9	**2.76**	**2.79**
TP14A	3.3	4	10.0	10.0	2.1	2.1	25	3.1	**3.31**	**4.85**
TP16A	3.7	4	10.0	10.0	1.3	1.3	25	2.3	**4.78**	**5.84**
TP12A	1.1	4	10.0	10.0	2.5	2.5	25	3.5	**8.34**	**12.89**
TP11A	6.9	4	10.0	10.0	1.3	1.3	25	2.3	**2.58**	**3.13**
TP9A	1.9	4	10.0	10.0	1.7	1.7	25	2.7	**7.10**	**9.68**
TP17A	3	4	10.0	10.0	2.2	2.2	25	3.2	**3.48**	**5.17**
TP8A	1.8	4	10.0	10.0	4.0	4	25	5.0	**3.19**	**5.52**
TP18A	9.6	4	10.0	10.0	0.3	0.3	25	1.3	**8.11**	**3.99**
TP22A	5.5	4	10.0	10.0	3.2	3.2	25	4.2	**1.31**	**2.15**

Calculated FoS of Natural Peat Slopes for Croagh Wind Farm - Drained Analysis

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	100% Water to height of Peat	Depth of In situ Peat	Friction Angle	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	(m)	ø' (deg)	Condition (2)	Condition (1) 100% Water	Condition (2) 100% Water
TP10A	8.8	4	10.0	10.0	0.4	0.4	25	1.4	**6.61**	**4.04**
TP3A	6.1	4	10.0	10.0	1.1	1.1	25	2.1	**3.44**	**3.88**
TP21A	4.3	4	10.0	10.0	2.9	2.9	25	3.9	**1.84**	**2.96**
TP15A	9.9	4	10.0	10.0	1.0	1	25	2.0	**2.36**	**2.52**
WP006b	3.7	4	10.0	10.0	2.8	2.8	25	3.8	**2.22**	**3.53**
WP007b	3.7	4	10.0	10.0	2.0	2	25	3.0	**3.11**	**4.47**
WP008b	6.5	4	10.0	10.0	1.9	1.9	25	2.9	**1.87**	**2.64**
WP009b	1.7	4	10.0	10.0	2.8	2.8	25	3.8	**4.82**	**7.68**
WP010b	2.6	4	10.0	10.0	1.8	1.8	25	2.8	**4.90**	**6.82**
WP011b	1	4	10.0	10.0	2.7	2.7	25	3.7	**8.49**	**13.42**
WP012b	2.6	4	10.0	10.0	3.7	3.7	25	4.7	**2.39**	**4.06**
WP013b	2.5	4	10.0	10.0	3.8	3.8	25	4.8	**2.42**	**4.14**
WP014b	2.5	4	10.0	10.0	3.7	3.7	25	4.7	**2.48**	**4.23**
WP017b	3.1	4	10.0	10.0	2.0	2	25	3.0	**3.70**	**5.34**
WP018b	3.3	4	10.0	10.0	2.1	2.1	25	3.1	**3.31**	**4.85**
WP020b	1.2	4	10.0	10.0	2.1	2.1	25	3.1	**9.10**	**13.34**
WP021b	2.1	4	10.0	10.0	2.6	2.6	25	3.6	**4.20**	**6.57**
WP022b	1.2	4	10.0	10.0	3.5	3.5	25	4.5	**5.46**	**9.19**
WP023b	2.1	4	10.0	10.0	4.5	4.5	25	5.5	**2.43**	**4.30**
WP024b	4.6	4	10.0	10.0	2.1	2.1	25	3.1	**2.38**	**3.48**
WP025b	3	4	10.0	10.0	2.2	2.2	25	3.2	**3.48**	**5.17**
WP026b	4.5	4	10.0	10.0	2.0	2	25	3.0	**2.56**	**3.68**
WP027b	4.7	4	10.0	10.0	1.8	1.8	25	2.8	**2.72**	**3.77**
WP028b	5	4	10.0	10.0	2.1	2.1	25	3.1	**2.19**	**3.21**
WP029b	3.3	4	10.0	10.0	0.7	0.7	25	1.7	**9.94**	**8.85**
WP030b	2.5	4	10.0	10.0	1.7	1.7	25	2.7	**5.40**	**7.36**
WP031b	7.4	4	10.0	10.0	0.8	0.8	25	1.8	**3.91**	**3.73**
WP032b	6.9	4	10.0	10.0	0.9	0.9	25	1.9	**3.73**	**3.79**
WP033b	8.6	4	10.0	10.0	1.0	1	25	2.0	**2.71**	**2.89**
WP034b	11.7	4	10.0	10.0	0.8	0.8	25	1.8	**2.52**	**2.37**
WP035b	10.5	4	10.0	10.0	0.8	0.8	25	1.8	**2.79**	**2.64**
CM379	3.5	4	10.0	10.0	2.4	2.4	25	3.4	**2.74**	**4.17**
CM380	2	4	10.0	10.0	2.4	2.4	25	3.4	**4.78**	**7.30**
CM381	1.3	4	10.0	10.0	2.5	2.5	25	3.5	**7.05**	**10.91**
CM390	4.8	4	10.0	10.0	2.1	2.1	25	3.1	**2.28**	**3.34**
CM391	4.2	4	10.0	10.0	1.2	1.2	25	2.2	**4.56**	**5.38**
CM392	2.2	4	10.0	10.0	1.8	1.8	25	2.8	**5.79**	**8.06**
CM393	4.2	4	10.0	10.0	1.0	1	25	2.0	**5.48**	**5.91**
CM394	1.3	4	10.0	10.0	2.0	2	25	3.0	**8.82**	**12.73**
CM397	5.1	4	10.0	10.0	0.6	0.6	25	1.6	**7.53**	**6.09**
CM398	7.9	4	10.0	10.0	1.0	1	25	2.0	**2.94**	**3.15**
CM399	5.6	4	10.0	10.0	0.2	0.2	25	1.2	**20.59**	**7.40**
CM400	6.4	4	10.0	10.0	0.5	0.5	25	1.5	**7.22**	**5.18**
CM401	No peat recorded at location									
CM422	7.2	4	10.0	10.0	2.3	2.3	25	3.3	**1.40**	**2.09**
CM423	6.7	4	10.0	10.0	1.1	1.1	25	2.1	**3.14**	**3.53**
CM424	8.1	4	10.0	10.0	1.0	1	25	2.0	**2.87**	**3.07**
CM425	3.3	4	10.0	10.0	1.6	1.6	25	2.6	**4.35**	**5.79**
CM426	10.4	4	10.0	10.0	1.1	1.1	25	2.1	**2.05**	**2.28**
CM427	8	4	10.0	10.0	1.5	1.5	25	2.5	**1.93**	**2.49**
CM429	6.5	4	10.0	10.0	1.5	1.5	25	2.5	**2.37**	**3.06**
CM430	7.1	4	10.0	10.0	1.5	1.5	25	2.5	**2.17**	**2.80**
PP	7.1	4	10.0	10.0	2.5	2.5	25	3.5	**1.30**	**2.00**
PP10	4.9	4	10.0	10.0	1.6	1.6	25	2.6	**2.94**	**3.90**
PP11	5.7	4	10.0	10.0	1.1	1.1	25	2.1	**3.68**	**4.15**
PP12	4.2	4	10.0	10.0	1.0	1	25	2.0	**5.48**	**5.91**
PP13	2.6	4	10.0	10.0	2.2	2.2	25	3.2	**4.01**	**5.97**
PP14	3.8	4	10.0	10.0	2.4	2.4	25	3.4	**2.52**	**3.84**
PP15	4.6	4	10.0	10.0	2.7	2.7	25	3.7	**1.85**	**2.92**
PP4	12.2	4	10.0	10.0	1.0	1	25	2.0	**1.94**	**2.05**
PP5	4	4	10.0	10.0	2.0	2	25	3.0	**2.87**	**4.14**
PP6	2.7	4	10.0	10.0	2.9	2.85	25	3.9	**2.98**	**4.78**
PP7	4.7	4	10.0	10.0	2.0	2	25	3.0	**2.45**	**3.52**
PP9	4.6	4	10.0	10.0	1.5	1.5	25	2.5	**3.34**	**4.32**
T10	8.6	4	10.0	10.0	1.5	1.5	25	2.5	**1.80**	**2.32**
WP001c	5.3	4	10.0	10.0	1.6	1.6	25	2.6	**2.72**	**3.61**
WP002c	4.4	4	10.0	10.0	0.8	0.8	25	1.8	**6.54**	**6.27**
WP003c	3.3	4	10.0	10.0	1.4	1.4	25	2.4	**4.97**	**6.27**
WP004c	4.9	4	10.0	10.0	1.2	1.2	25	2.2	**3.92**	**4.61**
WP005c	6.2	4	10.0	10.0	0.9	0.9	25	1.9	**4.14**	**4.22**
WP006c	7.6	4	10.0	10.0	0.9	0.9	25	1.9	**3.39**	**3.45**
WP009c	13.1	4	10.0	10.0	0.9	0.9	25	1.9	**2.01**	**2.01**
WP010c	15.1	4	10.0	10.0	0.7	0.7	25	1.7	**2.27**	**1.95**
WP011c	10	4	10.0	10.0	1.4	1.4	25	2.4	**1.67**	**2.08**
WP013c	9.6	4	10.0	10.0	0.9	0.9	25	1.9	**2.70**	**2.73**
WP018c	3.8	4	10.0	10.0	2.6	2.6	25	3.6	**2.33**	**3.63**
WP019c	5.3	4	10.0	10.0	1.6	1.6	25	2.6	**2.72**	**3.61**
WP020c	6.9	4	10.0	10.0	1.8	1.8	25	2.8	**1.86**	**2.57**
WP021c	5.2	4	10.0	10.0	1.9	1.9	25	2.9	**2.33**	**3.30**
WP022c	5.3	4	10.0	10.0	1.5	1.5	25	2.5	**2.90**	**3.75**
WP023c	8	4	10.0	10.0	1.0	1	25	2.0	**2.90**	**3.11**
WP024c	3.8	4	10.0	10.0	1.3	1.3	25	2.3	**4.65**	**5.68**
WP025c	13.9	4	10.0	10.0	0.6	0.6	25	1.6	**2.86**	**2.25**
WP026c	8.5	4	10.0	10.0	0.8	0.8	25	1.8	**3.42**	**3.25**
WP027c	3.3	4	10.0	10.0	1.6	1.6	25	2.6	**4.35**	**5.79**
mk0v3_562	12.8	4	10.0	10.0	1.2	1.2	25	2.2	**1.54**	**1.77**
mk0v3_563	8.2	4	10.0	10.0	1.0	1	25	2.0	**2.83**	**3.03**
mk0v3_564	3.9	4	10.0	10.0	3.5	3.5	25	4.5	**1.68**	**2.83**
mk0v3_565	3.3	4	10.0	10.0	2.7	2.7	25	3.7	**2.58**	**4.07**
mk0v3_566	2.8	4	10.0	10.0	2.8	2.8	25	3.8	**2.93**	**4.67**
mk0v3_567	2.4	4	10.0	10.0	3.0	3	25	4.0	**3.19**	**5.17**
mk0v3_568	5.8	4	10.0	10.0	3.4	3.4	25	4.4	**1.17**	**1.95**
mk0v3_569	6.2	4	10.0	10.0	3.4	3.4	25	4.4	**1.10**	**1.82**
								Minimum =	**1.02**	**1.47**
								Maximum =	**48.98**	**74.08**
								Average =	**4.69**	**5.41**

Notes:

(1) Assuming a bulk unit weight of peat of 10 (kN/m^3)
(2) Assuming a surcharge equivalent to fill depth of 1.0m.
(3) Slope inclination (β) based on site readings and contour survey plans of site.
(4) FoS is based on slope inclination and shear test results obtained from published data.
(5) Peat depths based on probes carried out by FT, Coillte, HES and MKO.
(6) For load conditions see Report text.
(7) Minimum acceptable factor of safety required of 1.3 for first-time failures based on BS: 6031:1981 Code of practice for Earthworks.

Appendix G

Methodology for Peat Stability Risk Assessment









Methodology for Peat Stability Risk Assessment

A peat stability risk assessment was carried out for each of the main infrastructure elements at the proposed wind farm development. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2017) and MacCulloch (2005). The degree of risk is determined as a Risk Rating (R), which is the product of probability (P) and impact (I). How these factors are determined and applied in the analysis is described below.

The main approaches for assessing peat stability include the following:

(a) Geomorphological

(b) Qualitative (judgement)

(c) Index/Probabilistic (probability)

(d) Deterministic (factor of safety)

Approaches (a) to (c) listed above would be considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach. As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified.

Probability

The likelihood of a peat failure occurring was assessed based on the results of both the quantitative results of stability calculations (deterministic approach using factors of safety) and the assessment of the severity of several qualitative factors which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability.

The qualitative factors used in the risk assessment are outlined in Table A and have been compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK.

Table A Qualitative Factors used to Assess Potential for Peat Failure

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
Evidence of sub peat water flow	No	Based on site walkover observations. Sub peat water flow generally occurs in the form of natural piping at the base of peat. Where there is a constriction or blockage in natural pipes a build-up of water can occur at the base of the peat causing a reduction in effective stress at the base of the peat resulting in failure; this is particularly critical during periods of intense rainfall.
	Possibly	
	Probably	
	Yes	
Evidence of surface water flow	Dry	Based on site walkover observations. The presence of surface water flow indicates if peat in an area is well drained or saturated and if any additional loading from the ponding of surface water onto the peat is likely.
	Localised/Flowing in drains	
	Ponded in drains	

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
	Springs/surface water	
Evidence of previous failures/slips	No	Based on site walkover observations. The presence of clustering of relict failures may indicate that particular pre-existing site conditions predispose a site to failure.
	In general area	
	On site	
	Within 500m of location	
Type of vegetation	Grass/Crops	Based on site walkover observations. The type of vegetation present indicates if peat in an area is well drained, saturated, etc. Vegetation that indicates wetter ground may also indicate softer underlying peat deposits.
	Improved Grass/Dry Heather	
	Wet Grassland/Juncus (Rushes)	
	Wetlands Sphagnum (Peat moss)	
General slope characteristics upslope/downslope from infrastructure location	Concave	Based on site walkover observations. Slope morphology in the area of the infrastructure location is an important factor. A number of recorded peat failures have occurred in close proximity to a convex break in slope.
	Planar to concave	
	Planar to convex	
	Convex	
Evidence of very soft/soft clay at base of peat	No	Based on inspection of exposures in general area from site walkover. Several reported peat failures identify the presence of a weak layer at the base of the peat along which shear failure has occurred.
	Yes	
Evidence of mechanically cut peat	No	Based on site walkover observations. Mechanically cut peat typically cut using a 'sausage' machine to extract peat for harvesting. Areas which have been cut in this manner have been linked to peat instability. The mechanical cuts can notably reduce the intrinsic strength of the peat and also allow ingress of rainfall/surface water.
	Yes	
Evidence of quaking or buoyant peat	No	Based on site walkover observations. Quaking/buoyant peat is indicative of highly saturated peat, which would generally be considered to have a

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor (1)	Explanation/Description of Qualitative Factor
	Yes	low strength. Quaking peat is a feature on sites that have been previously linked with peat instability.
Evidence of bog pools	No	Based on site walkover observations. Bog pools are generally an indicator of areas of weak, saturated peat. Commonly where there are open areas of water within peat these can be interconnected, with the result that there may be sub-surface bodies of water. The presence of bog pools have been previously linked with peat instability.
	Yes	
Other	Varies	In addition to the above features/ indicators and based on site recordings the following are some of the features which may be identified: Excessively deep peat, weak peat, overly steep slope angles, etc.

Note (1) The list of features/indicators for each qualitative factor are given in increasing order of probability of leading to peat instability/failure.

It should be noted that the presence of one of the qualitative factors alone from Table A is unlikely to lead to peat instability/failure. Peat instability/failure at a site is generally the combination of a number of these factors occurring at the same time at a particular location. The probability rating assigned to the quantitative and qualitative factors is judged on a 5-point scale from 1 (indicating negligible or no probability of failure) to 5 (indicating a very likely failure), as outlined in Table B.

Table B Probability Scale

Scale	Factor of Safety	Probability
1	1.30 or greater	Negligible/None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely
4	1.01 to 1.10	Probable
5	≤1.0	Very Likely

Scale	Likelihood of Qualitative Factor leading to Peat Failure	Probability of Failure
1	Negligible/None	Least
2	Unlikely	
3	Probable	
4	Likely	
5	Very Likely	Greatest

Impact

The severity of the risk is also assessed qualitatively in terms of impact. The impact of a peat failure on the environment within and beyond the immediate wind farm site is assessed based on the potential travel distance of a peat failure. Where a peat failure enters a water course it can travel a considerable distance downstream. Therefore the proximity of a potential peat failure to a drainage course is a significant indicator of the likely potential impact.

The risk is determined based on the combination of hazard and impact. A qualitative scale has been derived for the impact of the hazard based on distance of infrastructure element to a watercourse (Table C).

The location of watercourses is based on topographic maps and supplemented by site observations from walkover survey. Note that not all watercourses are shown on maps.

Table C Impact Scale

Scale	Criteria	Impact
1	Proposed infrastructure element greater than 150m of watercourse	Negligible/None
2	Proposed infrastructure element within 150 to 101m of watercourse	Low
3	Proposed infrastructure element within 100 to 51m of watercourse	Medium
4	Proposed infrastructure element within 50 m of watercourse	High
5	Proposed infrastructure element within 50 m of watercourse, in an environmentally sensitive area	Extremely High

Risk Rating

The degree of risk is determined as the product of probability (P) and impact (I), which gives the Risk Rating (R) as follows:

The Risk Rating is calculated from: $R = P \times I$

Due to the 5-point scales used to assess Probability and Impact, the Risk Rating can range from 1 to 25 as shown in Table D.

Table D Qualitative Risk Rating

Impact \ Probability	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Rating & Control Measures	
17 to 25	High: avoid working in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

The risk rating is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Low' risk rating. The control measures in response to the qualitative risk ratings are included in the peat stability risk registers for each main infrastructure element in Appendix E.

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

PROPOSED WINDFARM DEVELOPMENT AT CROAGH, CO. LEITRIM

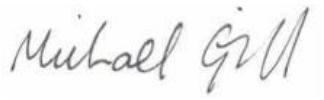
SITE SPECIFIC FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:
Coillte

Prepared by:
Hydro-Environmental Services

DOCUMENT INFORMATION

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SIGNED:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

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TABLE OF CONTENTS

1. INTRODUCTION 4
1.1 BACKGROUND 4
1.2 STATEMENT OF EXPERIENCE 4
1.3 REPORT LAYOUT & METHODOLOGY 5
2. BACKGROUND INFORMATION 6
2.1 INTRODUCTION 6
2.2 SITE LOCATION AND TOPOGRAPHY 6
2.3 PROPOSED DEVELOPMENT DETAILS 6
3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTIC 7
3.1 INTRODUCTION 7
3.2 BASELINE HYDROLOGY 7
3.2.1 Regional and Local Hydrology 7
3.2.2 Rainfall and Evaporation 8
3.3 GEOLOGY 9
3.4 DESIGNATED SITES & HABITATS 10
4. SITE SPECIFIC FLOOD RISK ASSESSMENT 11
4.1 INTRODUCTION 11
4.2 FLOOD ZONE MAPPING 11
4.3 FLOOD RISK IDENTIFICATION 12
4.3.1 Soils Maps – Fluvial Maps 12
4.3.2 Historical Mapping 12
4.3.3 OPW National Flood Hazard Mapping 12
4.3.4 Preliminary Flood Risk Assessment Maps – Fluvial and Pluvial Flooding 13
4.3.5 Summary – Flood Risk Identification 14
4.4 INITIAL FLOOD RISK ASSESSMENT 15
4.4.1 Site Survey 15
4.4.2 Existing Site Drainage 15
4.4.3 Hydrological Flood Conceptual Model 16
4.4.4 Summary – Initial Flood Risk Assessment 16
4.5 REQUIREMENT FOR A JUSTIFICATION TEST 16
5. FLOOD IMPACT PREVENTION AND SURFACE WATER MANAGEMENT 18
5.1.1 Proposed Drainage 18
5.1.2 Relevant SuDs Guidance 18
5.1.3 On Site Flood Attenuation 18
5.1.4 Flood Impact Screening for Designated Sites 19
6. FRA REPORT CONCLUSIONS 20
7. REFERENCES 21

FIGURES IN TEXT

Figure A: Site Location Map 4
Figure B: Local Hydrology Map 8
Figure C: Local subsoils map 10
Figure D: OPW Indicative Floods Map (www.floods.ie) 13
Figure E: Flood debris at Gubbadarra, northwest of Arigna, July 1992 (www.floodinfo.ie) 13
Figure F: PFRA Fluvial Flood Zone Mapping CFRAM Maps – Fluvial and Coastal Flooding 14
Figure G: Schematic of typical forestry drainage layout. 15

TABLES IN TEXT

Table A: Summary of Local Hydrology and Proposed Infrastructure 8
Table B: Rainfall return period depths for Croagh WF site 9
Table C: S-P-R Assessment of Flood Sources for the proposed site 16
Table D: Matrix of Vulnerability versus Flood Zone 17
Table E: Flood Impact Screening for Local Designated Sites 19

No table of figures entries found.

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO Ireland, on behalf of Coillte, to undertake a site specific Stage II Flood Risk Assessment (FRA) for a proposed windfarm development at Croagh, Co. Leitrim. A site location map is shown below as **Figure A.**

This FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009).

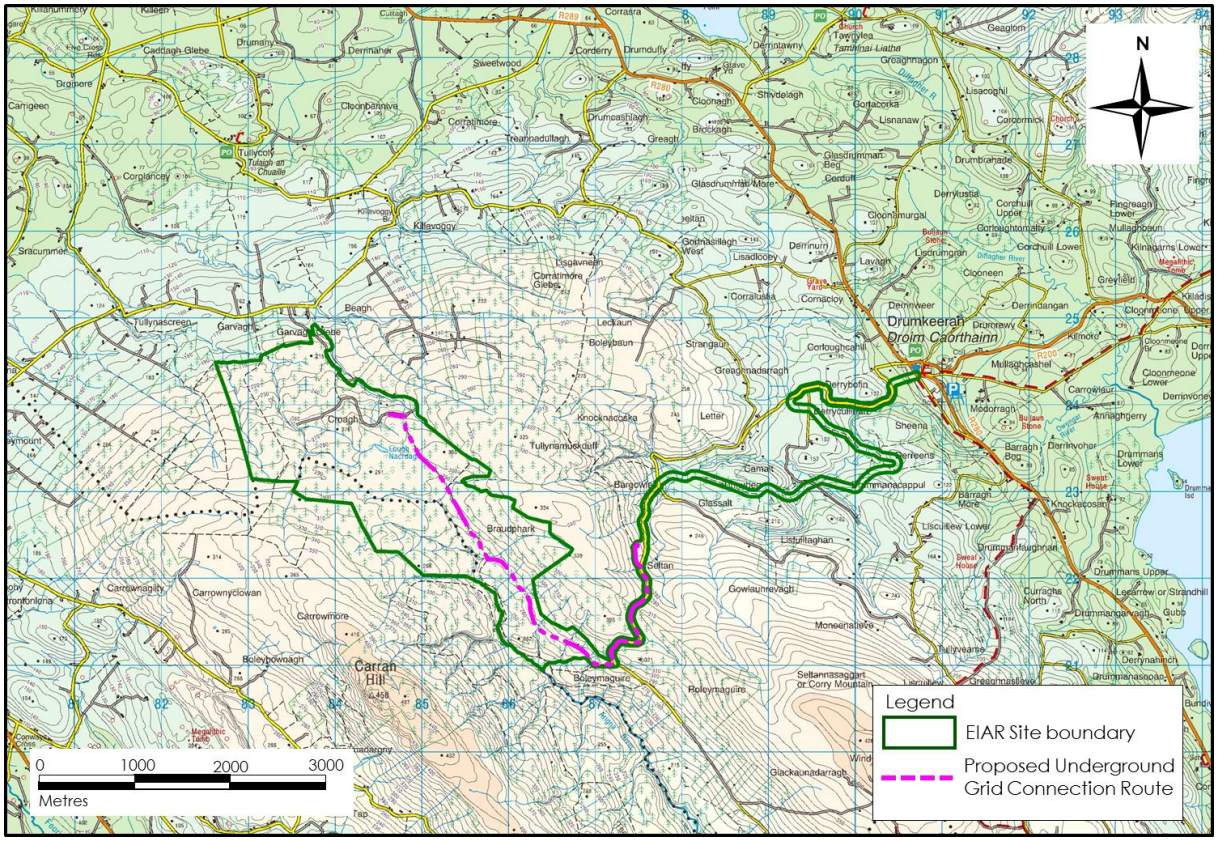


Figure A: Site Location Map

1.2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling, and prepare flood risk assessment reports.

Michael Gill is an Environmental Engineer with 18 years environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. Michael has significant experience in surface water drainage issues, SUDs design, and flood risk assessment.

Adam Keegan is a junior hydrogeologist with 2 years' experience in the environmental/engineering sector.

1.3 REPORT LAYOUT & METHODOLOGY

This FRA report has the following format:

- Section 2 describes the proposed site setting and details of the proposed development;
- Section 3 outlines the hydrological and geological characteristics of the local surface water catchment in the vicinity of the proposed development site;
- Section 4 deals with a site-specific flood risk assessment (FRA) undertaken for the proposed development which was carried out in accordance with the above-mentioned guidelines;
- Section 5 completes a Justification Test for the development; and,
- Section 6 presents the FRA report conclusions.

As stated above this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood related information from the following data sources:

- Base maps – Ordnance Survey of Ireland;
- Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie;
- Office of Public Works (OPW);
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- EPA hydrology maps;
- Preliminary Flood Risk Assessment Maps; and,
- Site Walkover and drainage mapping.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the proposed site along with a description of the proposed development.

2.2 SITE LOCATION AND TOPOGRAPHY

The Proposed Development site is located approximately ~1.3 kilometres west of Drumkeeran, Co. Leitrim. The total study area/landholding is approximately 653 ha (~6.53km^2). Current access to the site is via a small local road which runs from Drumkeeran towards the site. This road then turns south towards Boleymaguire and the southern tip of the site, where access can be gained at various forestry barriers.

The southern section of the wind farm site covers a topographically high area close (approximately 1.5km) to the peak of Carrane Hill. The ground slopes in a northeasterly direction from this southern section and from along the western flank of the site, towards the east and north. The ground continues to slope in a northward direction towards the local road which wraps around the base of Carrane Hill.

The land use within the site areas comprises mainly of commercial coniferous forestry. A site location map is shown as **Figure A** above.

2.3 PROPOSED DEVELOPMENT DETAILS

The proposal consists of a windfarm of 10 no. turbines and associated access roads and infrastructure, grid cable route, substation, construction compound, borrow pits, peat deposition areas and amenity walkways/boardwalks. It is proposed that the road construction will utilise the cut and fill construction method. Scour protection, which is detailed further below, will be provided along sections of access tracks as an erosion protection measure from fluvial flooding. There will also be a requirement to upgrade bridges and culverts at the streams that are intersected by the proposed access track alignments and create new bridges and culverts on new access tracks that cross watercourses.

The proposed construction site entrance access road/turbine delivery road for the wind farm commences from the R280 at Drumkeeran village, approximately 4.8km to the northeast (as the crow flies) of the main site area and traverses private land, a public road and Coillte property (with some short sections in third party lands) before emerging onto the local road that approaches the core wind farm site.

There is 1 no. proposed grid route being assessed, along with 1 no. proposed substation. The proposed substation is located approximately 330 metres east of Turbine No. 4 along an existing access road. From here, the proposed underground grid connection cabling route runs southeast along existing forestry roads for ~ 4.1 km before turning north and following the public road for ~ 1.9km and connecting with the existing Garvagh Glebe 110kV substation.

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTIC

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics in the area of the proposed forest access road.

3.2 BASELINE HYDROLOGY

3.2.1 Regional and Local Hydrology

On a regional scale, the proposed site is located within Hydrometric Area 26 (Upper Shannon) and 35 (Sligo Bay & Drowse) within the (WRBD). The proposed site is located within the Bonet (35_6) and the Arigna (26A_4).

There are four main rivers which drain the Proposed Development site, namely the upper reaches of the Killanummery River (IE_WE_35K030600) which drains the north-western section of the site. The Killanummery River continues to flow northwest, before meeting the River Bonet just south of Dromahair, approximately 7.5 km north of the site. The smaller Tullynascreen Stream (IE_WE_35K030600) runs parallel to this river, and flows northwest, meeting the Killanummery River approximately 2 km north of the site. The Tullynascreen Stream emanates from Lough Nacroagh, a small lake with an area of ~0.01 km^2.

The Cashel Stream drains the north-eastern section of the proposed site. The Cashel Stream is fed from several smaller streams which converge near Kilavoggy Bridge ~1.5km north of the site. The stream then flows north/northeast, meeting the River Bonet approximately 1 km southeast of Dromahair.

The southern section of the proposed site is drained by the Arigna River. The Arigna River runs south through the site and delineates much of the southwestern boundary of the site. It flows through a steep valley between Carrane Hill and Corry Mountain, and the drainage network suggest it is fed primarily from surface waters draining from the peaked ridge of Carrane Hill, which runs parallel to the river, approximately 1 km southwest of the river. The Arigna River continues to flow south before discharging into the southern tip of Lough Allen, some 3km northwest of Drumshanbo.

The site construction access road is drained by several headwater streams that flow easterly to form the Owengar River which flows into Lough Allen which is located 2km east of the site entrance.

Table A: Summary of Local Hydrology and Proposed Infrastructure

Hydrometric Area	Sub-catchment	Main Development Infrastructure	Primary Drainage Features
Upper Shannon	Arigna	4 no. turbines, 1 no. borrow pit, 1 no. peat repository area,1 no. construction compound and 1.4km of the grid connection route and boardwalk	Arigna River
	Owengar	3.95km of the grid connection route and 8.5km of the construction site access road	Owengar River
Garvogue	Bonet	6 no. turbines, substation, 1 no. peat repository area, 1 no. construction compound, 0.6km of the Garvagh grid connection route and met mast	Killanummery River, Cashel Stream

A local hydrology map of the area which shows the WFD sub-catchments is shown as **Figure B** below.

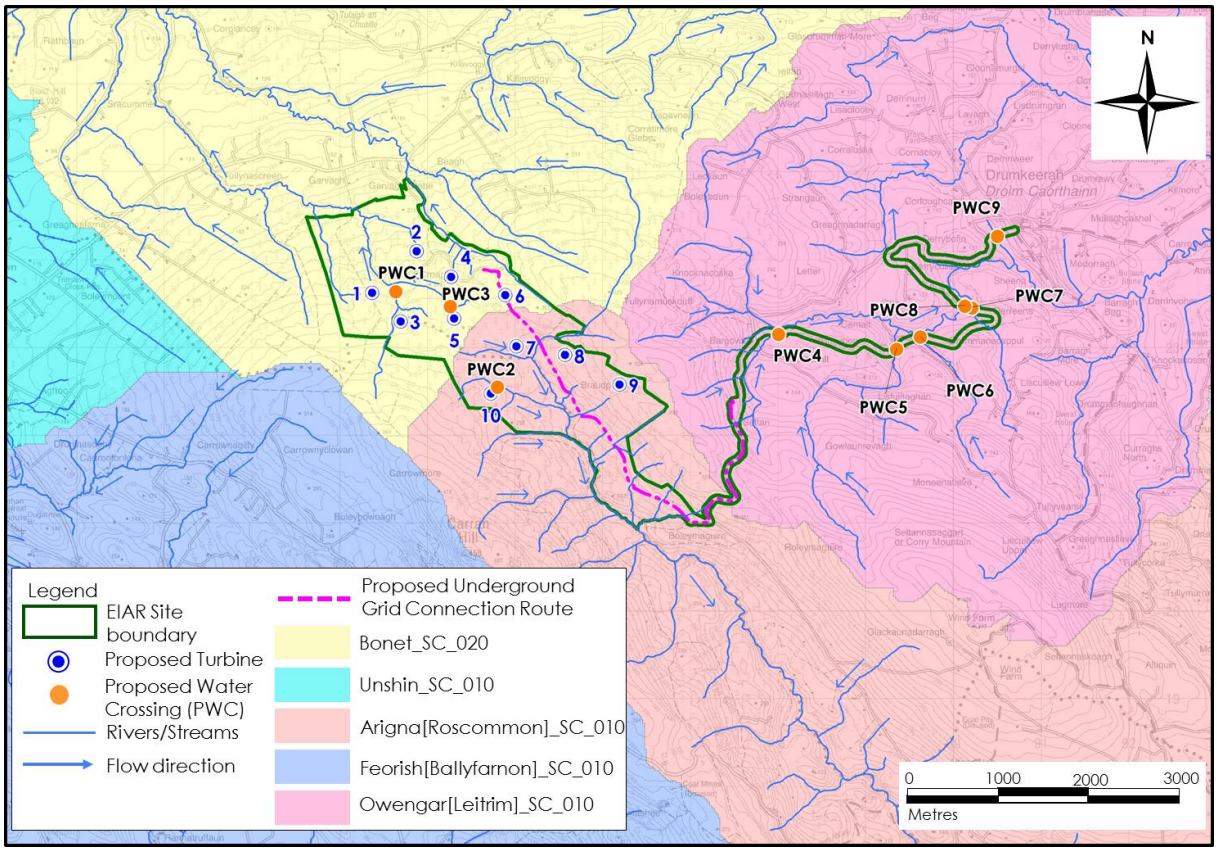


Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Dromahair, approximately 4km east of the proposed site, is 1231mm (www.met.ie). The average potential evapotranspiration (PE) at Mullingar, approximately 80km southeast of the proposed site, is 446mm/yr (www.met.ie). The actual evapotranspiration ("AE") is calculated to be 423mm (95% PE).

Using the above figures the effective rainfall ("ER")[1] for the area is calculated to be (ER = SAAR – AE) 808mm.

Based on recharge coefficient estimates from the GSI (www.gsi.ie), an estimate of 5% recharge is taken for the site as an overall average. This value is for "Peat" with a "High" vulnerability rating. Areas where peat is absent may have slightly higher recharge rates, but on this site, these areas are generally on sloping ground. The high stream density in the area would also suggest that recharge rates are very low.

The lowest value in the available range was chosen to reflect the large coverage of blanket peat and high drainage density. Therefore, annual recharge and runoff rates for the site are estimated to be 40mm/yr and 768mm/yr respectively.

Table B below presents return period rainfall depths for the area of the proposed Croagh wind farm site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year). These extreme rainfall depths will be the basis of the proposed wind farm drainage hydraulic design as described further below.

Table B: **Rainfall return period depths for Croagh WF site**

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	4.2	7.0	11.7	16.1
15 mins	7.0	11.5	19.2	26.4
1 hour	11.9	18.5	29.0	38.3
6 hours	23.9	34.2	49.4	62.0
12 hours	31.2	43.3	60.7	74.8
24 hours	40.9	55.0	74.6	90.1
2 days	52.8	69.0	90.8	107.7

3.3 GEOLOGY

According to GSI mapping (**www.gsi.ie**), soils are mapped generally as predominantly blanket peat, with areas of poorly drained mineral soils with peaty topsoil derived from mainly acidic parent material (AminPDPT) towards the north of the site and along the southern and eastern edges of the site. A small area of shallow reasonably drained mineral soil (AminSRPT) is mapped also.

The GSI subsoils map (www.gsi.ie) shows the majority of the site mapped as Blanket peat. An area of the site is mapped as Tills derived from Namurian sandstones and shales (TNSSs), this is mainly around the banks of the Killanummery and Cashel stream at the north of the site and also along the construction access road. A subsoils map of the area is shown as **Figure C** below.

The underlying bedrock at the Proposed Development site is mapped by the GSI as being broadly Namurian shales. The Dergvone Formation encompasses the majority of the site, consisting of a number of shale facies with occasional thin beds of ironstone and flaggy sandstone.

The northwestern tip of the site is underlain by rocks which are Dinantian in age. They are part of the Carraun Shale Formation consisting of grey to black fossiliferous shales and mudstones with thin subordinate limestones and dolomites.

[1] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

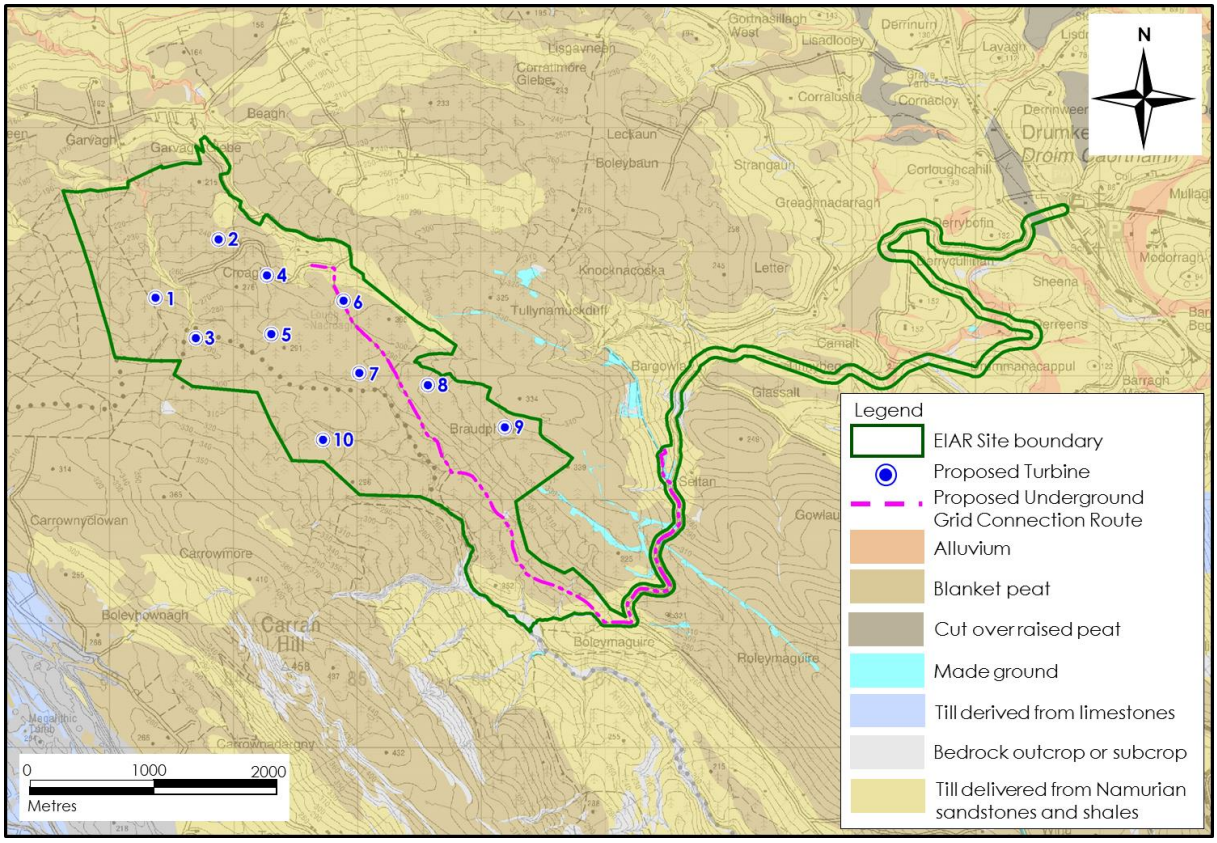


Figure C: Local subsoils map

3.4 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include National Heritage Areas (NHAs), proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

The eastern boundary of the site is bounded by the Corry Mountain Bog NHA. As the NHA is entirely above (in elevation) the proposed development area, no part of the proposed development areas drain towards this designated site.

The closest SAC to the site is Boleybrack Mountain SAC located approximately 8 km northeast of the proposed development site. No areas of the site drain in this direction. Similarly, Lough Arrow, a SAC, SPA and NHA is located approximately 9km southwest of the site. The majority of the northern section of the Proposed Development site ultimately drains into the Bonet River which then flows through the Lough Gill SAC, located approximately 10km north of the site.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water runoff;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

A stage 1 assessment of flood risk requires an understanding of where the water comes from (*i.e.* the source), how and where it flows (*i.e.* the pathways) and the people and assets affected by it (*i.e.* the receptors). It is necessary to identify whether there may be any flooding or surface water management issues related to the proposed site that may warrant further detailed investigation.

As per the guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site; and,
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development.

Further to this, a stage 2 assessment involves the confirmation of sources of flooding, appraising the adequacy of existing information and determining what surveys and modelling approach may be required for further assessment.

4.2 FLOOD ZONE MAPPING

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined for these purposes according to OPW guidelines:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Soils Maps – Fluvial Maps

A review of the soil types in the vicinity of the proposed site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas.

Based on the EPA/GSI soil map for the area it appears that there are small areas of mineral alluvium soils (fluvial deposits) mapped along various rivers/streams discussed above. The most abundant deposition of Alluvium is mapped along the Arigna river to the south of the site, however most of the Alluvium deposition occurs further south of the site boundary. There are very localised areas of Alluvium mapped towards the northern boundary of the site, along the Cashel stream and minor deposits along the Killanummery.

In general, however there is no significant alluvium deposition that would be associated with a flood plain or a large geographical area prone to flooding.

4.3.2 Historical Mapping

There is no text on local available historical 6" or 25" mapping for the proposed site that identify areas that are "*prone to flooding*" along the proposed route.

4.3.3 OPW National Flood Hazard Mapping

The OPW Indicative Flood Maps have no records of recurring flood incidences within the site. The closest mapped flood event is along the R280, some 200m to the south of the construction access road entrance (refer to **Figure D** below).

There is evidence of past flood events (from www.floodinfo.ie) within the Arigna River channel, approximately 2.5 km north of Arigna, which includes photographs of flood debris/washout on roads at Gubbaradda, on the higher ground to the southwest of the river (refer to Error! Reference source not found. below).

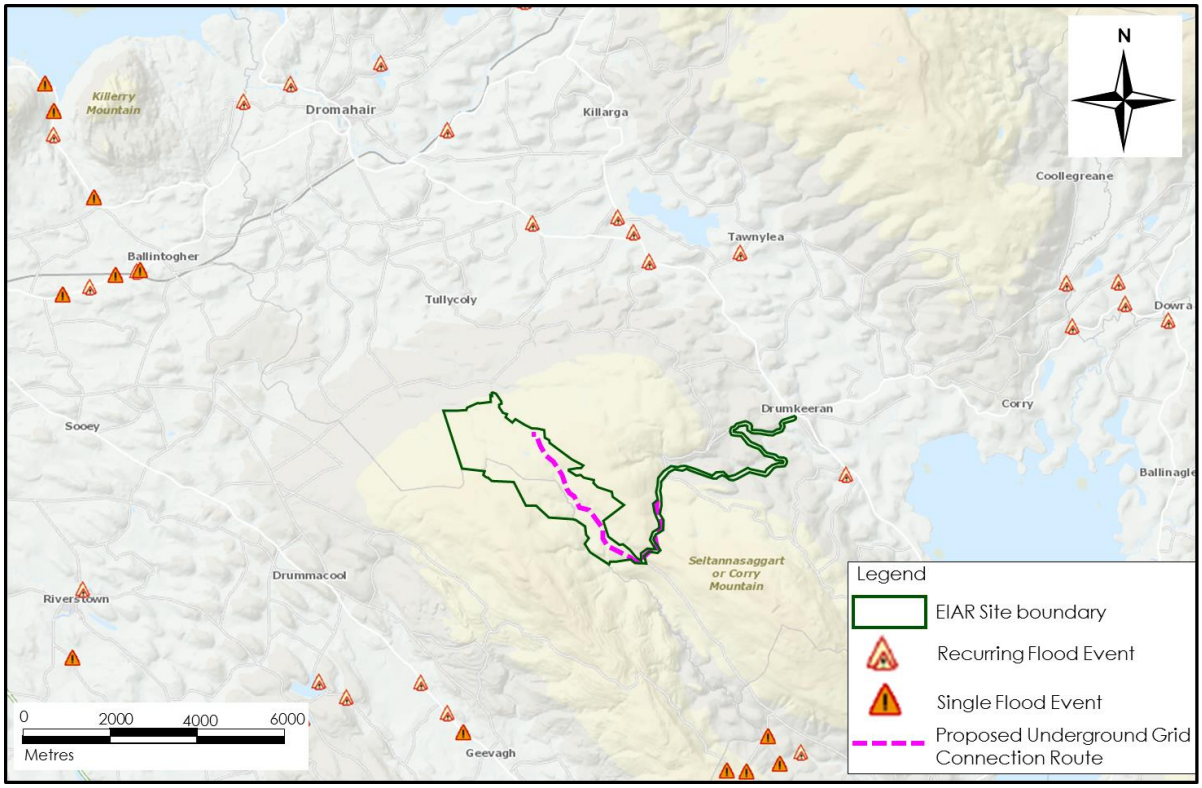


Figure D: OPW Indicative Floods Map (www.floods.ie)



Figure E: Flood debris at Gubbaddarra, northwest of Arigna, July 1992 (www.floodinfo.ie)

4.3.4 Preliminary Flood Risk Assessment Maps – Fluvial and Pluvial Flooding

The PFRA draft flooding maps were queried (via www.myplan.ie/webapp) for areas prone to flooding. The Arigna river channel, which runs through much of the west/south of the site is mapped as a Flood Zone A (1% AEP). The extent of the mapped flood zone is localised to within several metres either side of the river channel.

The Cashel stream/Killanummery river have small areas mapped as Flood Zone A towards the northern boundary of the site, close to the local road.

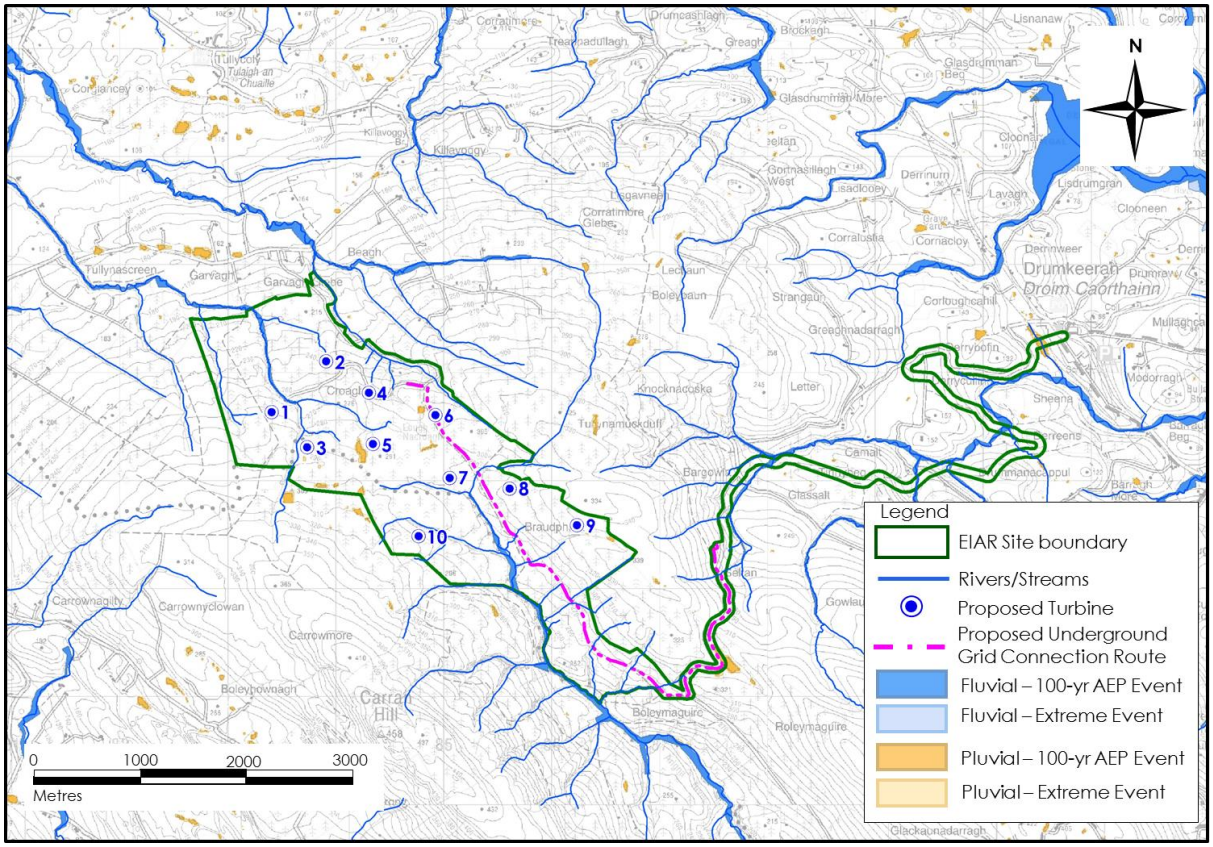


Figure F: PFRA Fluvial Flood Zone Mapping CFRAM Maps – Fluvial and Coastal Flooding

Where complete the Catchment Flood Risk Assessment and Management (CFRAM)[2] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the Preliminary Flood Risk Assessment Maps (PFRA) maps. However, CFRAM mapping is not currently available for the area of the proposed site, and this indicates that the flooding at the site is not a major concern.

4.3.5 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, it is evident that small parts of the site immediately surrounding the various river channels are within 1 in 100 year fluvial flood zones. These mapped zones occur towards the south of the site, along the Arigna river and in localised areas to the north, and also near the Cashel stream and Killanummery river. They are limited in extent and do not coincide with the key areas of development (e.g. substation/turbines). All key infrastructure is located in Flood Zone C (Low Risk). Some of the existing watercourse crossings intercept the 100-year flood zone.

[2] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011, and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Survey

A detailed walkover survey of the proposed site, grid connection route and construction access road was undertaken by HES during November 2018, September 2019 and March 2020.

The first round of sampling on 14th November 2018 followed a period of extended heavy rain. No flooding or out of bank flow was observed. The flows on this date were estimated to be ~8-10 times higher than those observed the following week on the 20th November 2018.

As discussed above, several rivers have their upper reaches within the proposed development site, and flow within either the Arigna or Bonet subcatchment. Sections of the proposed development site are located within the 100-year fluvial flood zone, however no turbines or the substation or other key infrastructure are located within Flood Zone A or Flood Zone B.

4.4.2 Existing Site Drainage

The forestry drains are the primary drainage routes towards the natural streams on the development site, but the flows in these drains are generally very low. The integration of the existing main drains with the proposed wind farm drainage is a key component of the drainage design.

Within the Proposed Development site there are numerous manmade drains that are in place predominately to drain the forestry plantations. Mound drains and ploughed ribbon drains are generally spaced approximately every 15m and 2m respectively. As illustrated in **Figure G**, interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. Interceptor drains are also located up-gradient of forestry access roads. Culverts are generally located at stream crossings and at low points under access roads which drain runoff onto down-gradient forest plantations.

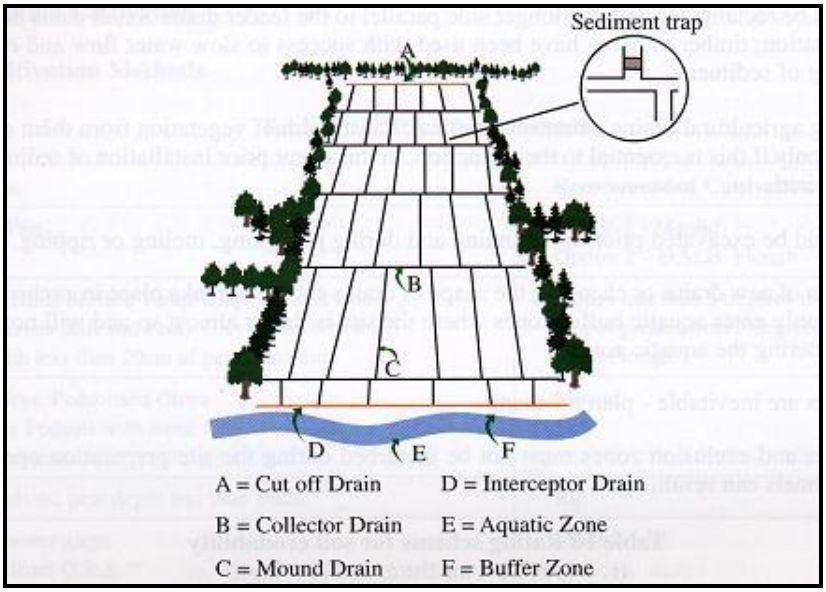


Figure G: Schematic of typical forestry drainage layout.

4.4.3 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the proposed site can be described using the Source – Pathway – Receptor Model ("S-P-R"). The primary potential source of flooding in this area, and the one with most consequence for the proposed site, is fluvial. The primary potential pathways, in the most likely order of significance, would be overbank flooding of the Arigna and Killanummery rivers as well as the Cashel Stream during significant rainfall events. The potential receptors in the area are infrastructure and land as outlined below.

4.4.4 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it is apparent that flooding is unlikely to be problematic at the site or downstream of the site. The potential sources of flood risk for the proposed site are outlined and assessed in **Table C**.

Table C: S-P-R Assessment of Flood Sources for the proposed site

Source	Pathway	Receptor	Comment
Tidal	Not applicable	Land and infrastructure.	The proposed site is >10km from the coast and there is no risk of coastal flooding.
Fluvial	Overbank flooding of the Arigna, Killanummery, Cashel Stream	Land and infrastructure.	Fluvial flood will be localised to the streams and rivers. All key infrastructure (i.e. turbines, substation, compound etc) is located in Flood Zone C (Low Risk).
Pluvial	Ponding of rainwater on site	Land and infrastructure.	There is very little risk of pluvial flooding within the proposed site as drainage moves relatively freely. Small localised areas of pluvial flooding are mapped.
Surface water	Surface ponding/ Overflow	Land and infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land and infrastructure.	Based on local hydrogeological regime and PFRA mapping, there is no apparent risk from groundwater flooding.

4.5 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[3] is shown in **Table D** below.

It may be considered that the proposed wind farm can be categorised as "Highly Vulnerable Development" However, as stated above, with the exception of watercourse crossings (many already existing), all proposed infrastructure, including the proposed substation, is located in Flood Zone C (Low Risk) and therefore the proposed development is appropriate from a flood risk perspective (refer to **Table D** below).

[3] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

Table D: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	**Appropriate**
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: Taken from Table 3.2 (DoEHLG, 2009)
***Bold:** Applies to this project*

5. FLOOD IMPACT PREVENTION AND SURFACE WATER MANAGEMENT

5.1.1 Proposed Drainage

The site drainage system was designed integrally with the wind farm layout as a measure to ensure that the proposal will not change the existing flow regime across the site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff.

Overland flow rates are therefore likely to be very significant and the drainage system must be designed and managed properly if it is to work effectively. A fundamental principle in the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing streams, is allowed to bypass the works areas without being contaminated by silt from the works. The dirty water from the works areas is collected in a separate drainage system and treated by removing the suspended solids before discharging it to the downstream watercourse. This minimises the volume of dirty water requiring treatment.

All new watercourse crossing will be clear span bridges and these will not effect on site flooding. New drains will be constructed to collect overland flow that is intercepted by the works areas or by new access roads. These will be constructed on the uphill side of the works and piped to the downhill side, bypassing the works areas. However, this will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. In order to disperse this flow, each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation. This will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters.

The resultant diversion of clean water runoff will ensure that the treatment system will only need to deal with construction related runoff. The treatment system consists of a series of settlement ponds that are located at each works site and at intervals along the access roads. The outflow from the settlement ponds will be allowed to disperse across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering the downstream watercourses.

5.1.2 Relevant SuDs Guidance

Guidance in relation to surface water management and sustainable urban drainage is also provided in the Leitrim County Development Plan 2015-2021. *Section 3.2* of the development plan states that:

"Surface water drainage systems are effective at transferring surface water quickly, but they can cause the volume of water in the receiving watercourse to increase more rapidly thereby increasing flood risk. Sustainable Drainage Systems (SuDS) can play a role in reducing and managing run-off to surface water drainage systems as well as improving water quality. For larger developments, the use of Sustainable urban Drainage Systems (SuDS) techniques will be favoured"

5.1.3 On Site Flood Attenuation

The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage system and this may increase flood risk and flood severity downstream. This applies particularly to urban areas that drain to closed pipe systems which do not have the capacity to cater for increased hydraulic loads. The proposed Croagh wind farm development is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase

in runoff rate is very small in the context of the catchment size and therefore represents a negligible increase in downstream flood risk. Notwithstanding the low increase in flood risk due to the development, the drainage system has been designed to prevent any increase in discharge rates above that which already exist in the undeveloped site.

The volume of water requiring attenuation relates to direct precipitation on the roads and hard-standing footprint only. The aim of the storm water attenuation measures is to limit the flow rate from the developed area to that which prevails on the undeveloped site. This is achieved by limiting the flow rate to the downstream receiving waters and temporarily storing the excess water that accumulates as a result. The developed surfaces have some permeability and this reduces the attenuation requirement. Conventional attenuation systems use proprietary flow control units but these can become blocked with debris and vegetation and require regular maintenance. They are therefore not appropriate for use within a forestry environment or where routine maintenance would not be practical.

It is proposed to provide the temporary storage within the drainage channels by creating stone (check) dams within them at regular intervals. The spacing of the dams is typically 100m but depends on the channel slope, with steeper channels requiring shorter spacing intervals. The check dams, which are constructed with small sized aggregate, also reduce the flow rate through the drainage system and are an effective means of providing flow control. Silt fences also provide storage and flow control.

All runoff from the developed areas will be routed through settlement ponds downstream. The outflow from the settlement ponds will be released in a controlled and diffuse manner onto the vegetation or forestry floor where selected forestry rills may be blocked to further promote diffusion of runoff. Therefore, the proposal will not increase the magnitude of the hydrograph peak. The control measures are passive as opposed to mechanical and do not require maintenance to ensure their ongoing effectiveness.

5.1.4 Flood Impact Screening for Designated Sites

Table E below provides a flood impact screening for local designated sites.

Table E: Flood Impact Screening for Local Designated Sites

Name	Site Code	Flood Risk Screening
Carrane Hill Bog NHA	002415	No increased flood risk, attenuation proposals outlined above.
Corry Mountain Bog NHA	002321	No increased flood risk, attenuation proposals outlined above.
Boleybrack Mountain SAC	002032	No increased flood risk, attenuation proposals outlined above.
Lough Arrow SAC, SPA, NHA	001673	No increased flood risk, no hydrological connection.
Corry Mountain Bog NHA	002321	No increased flood risk; steep, well drained slopes.
Lough Gill SAC	001976	No increased flood risk.

6. FRA REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed Croagh wind farm development at Carrane Hill, Co. Leitrim. From this study:
    - No instances of historical flooding were identified in historic OS maps;
    - No instances of recurring flooding were identified on OPW maps within the proposed development site; and,
    - Areas of the proposed site were identified with the PFRA Flood Zones as described below.
- The Preliminary Flood Risk Assessment (PFRA) mapping indicates that there are areas of the proposed site located in the fluvial Flood Zone A, however these areas do not coincide with proposed turbine locations, substation or other key development related infrastructure;
- The remainder of the proposed site is not mapped as susceptible to flooding, aside from isolated small areas where pluvial flooding may occur; however as before, these areas do not coincide with any areas of proposed infrastructure or development;
- It may be considered that the proposed wind farm can be categorised as "Highly Vulnerable Development", however with the exception of watercourse crossings, all proposed infrastructure is located in Flood Zone C (Low Risk) and therefore the proposed development is appropriate from a flood risk perspective;
- The overall risk of flooding posed by the development of a wind farm at the proposed development site is estimated to be low; and,
- In addition, the risk of the wind farm contributing to downstream flooding is also very low, as the long-term plan for the site is to retain and slow down drainage water prior to release. Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls.

* *

7. REFERENCES

AGMET	1996	Agroclimatic Atlas of Ireland.
DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Leitrim County Council	2015	Leitrim County Development Plan – Strategic Flood Risk Assessment 2015-2021.

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22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: HYDR-151151118
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 15/11/2018
Date Reported 27/11/2018
Order Number P1459

For the Attention of: Hydro Environmental Services

Sample Reception 6 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Date Received 15/11/2018
Date Reported 27/11/2018
Order Number P1459

Sample Type Water
Client ID P1459-SW1
Date Tested 15/11/2018
ALS ID 3302604

Test	Result	Unit	Method
Suspended Solids	17	mg / l	P202
Phosphorus	0.14	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	11.0	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.04	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID P1459-SW3
Date Tested 15/11/2018
ALS ID 3302605

Test	Result	Unit	Method
Suspended Solids	17	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	12.6	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.04	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
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Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
www.alsglobal.ie

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Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 15/11/2018
Date Reported 27/11/2018
Order Number P1459

Sample Type Water
Client ID P1459-SW6
Date Tested 15/11/2018
ALS ID 3302606

Test	Result	Unit	Method
Suspended Solids	27	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	12.6	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.05	mg/l NH3-N	P281
Nitrogen (Total)	1.0	mg/L N	P285

Sample Type Water
Client ID P1459-SW8
Date Tested 15/11/2018
ALS ID 3302607

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	9.0	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
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Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
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Date Received 15/11/2018
Date Reported 27/11/2018
Order Number P1459

Sample Type Water
Client ID P1459-SW10
Date Tested 15/11/2018
ALS ID 3302608

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	9.6	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID P1459-SW12
Date Tested 15/11/2018
ALS ID 3302609

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	10.4	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
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Report No: HYDR-388211118
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 21/11/2018
Date Reported 29/11/2018
Order Number P1459

For the Attention of: Hydro Environmental Services

Sample Reception 6 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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CERTIFICATE OF ANALYSIS

Date Received 21/11/2018
Date Reported 29/11/2018
Order Number P1459

Sample Type Water
Client ID P1459-SW1
Date Tested 22/11/2018
ALS ID 3309858

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.1	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Ammonia	0.03	mg/l NH3-N	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	0.03	mg/l P	P281
Chloride	9.8	mg/l CL	P281
Nitrogen (Total)	5.7	mg/L N	P285

Sample Type Water
Client ID P1459-SW3
Date Tested 22/11/2018
ALS ID 3309859

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.1	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	12.1	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	7.6	mg/L N	P285

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Environmental Chemistry Manager

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Date Received 21/11/2018
Date Reported 29/11/2018
Order Number P1459

Sample Type Water
Client ID P1459-SW6
Date Tested 22/11/2018
ALS ID 3309860

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.11	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	12.9	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.08	mg/l NH3-N	P281
Nitrogen (Total)	5.5	mg/L N	P285

Sample Type Water
Client ID P1459-SW8
Date Tested 22/11/2018
ALS ID 3309861

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.1	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	9.9	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	7.2	mg/L N	P285

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Rosemary Thomas
Environmental Chemistry Manager

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Date Received 21/11/2018
Date Reported 29/11/2018
Order Number P1459

Sample Type Water
Client ID P1459-SW10
Date Tested 22/11/2018
ALS ID 3309862

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.1	mg/l P	P207
BOD 5 day Total with ATU	3	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	9.7	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	2.2	mg/L N	P285

Sample Type Water
Client ID P1459-SW12
Date Tested 22/11/2018
ALS ID 3309863

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.11	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	9.8	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	4.1	mg/L N	P285

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Environmental Chemistry Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: HYDR-530060919
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 06/09/2019
Date Reported 12/09/2019
Order Number P1459

For the Attention of: Hydro Environmental Services

Sample Reception 10 sample(s) received in good condition.

Comments Carrane hill

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Report No: HYDR-530060919

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CERTIFICATE OF ANALYSIS

Date Received 06/09/2019
Date Reported 12/09/2019
Order Number P1459

Sample Type Surface Water
Client ID SW1
Date Tested 07/09/2019
ALS ID 3664639

Test	Result	Unit	Method
Suspended Solids	8	mg / l	P202
Phosphorus	0.11	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	8.8	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.3	mg/L N	P285

Sample Type Surface Water
Client ID SW7
Date Tested 07/09/2019
ALS ID 3664640

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	8.8	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.4	mg/L N	P285

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Rosemary Thomas
Environmental Chemistry Manager

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Date Received 06/09/2019
Date Reported 12/09/2019
Order Number P1459

Sample Type Surface Water
Client ID SW5
Date Tested 07/09/2019
ALS ID 3664641

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	5.1	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.1	mg/L N	P285

Sample Type Surface Water
Client ID SW6
Date Tested 07/09/2019
ALS ID 3664642

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	10.0	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	1.7	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
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Fax:+353 (0) 52 617 8103
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Date Received 06/09/2019
Date Reported 12/09/2019
Order Number P1459

Sample Type Surface Water
Client ID SW8
Date Tested 07/09/2019
ALS ID 3664643

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	8.5	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	2.7	mg/L N	P285

Sample Type Surface Water
Client ID SW9
Date Tested 07/09/2019
ALS ID 3664644

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	8.2	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.04	mg/l NH3-N	P281
Nitrogen (Total)	1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
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Fax:+353 (0) 52 617 8103
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Report No: HYDR-530060919

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 06/09/2019
Date Reported 12/09/2019
Order Number P1459

Sample Type Surface Water
Client ID SW11
Date Tested 07/09/2019
ALS ID 3664645

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	5.8	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.0	mg/L N	P285

Sample Type Surface Water
Client ID SW12
Date Tested 07/09/2019
ALS ID 3664646

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	7.9	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.5	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
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Fax:+353 (0) 52 617 8103
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Report No: HYDR-530060919

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 06/09/2019
Date Reported 12/09/2019
Order Number P1459

Sample Type Surface Water
Client ID SW16
Date Tested 07/09/2019
ALS ID 3664647

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	9.3	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.5	mg/L N	P285

Sample Type Surface Water
Client ID SW17
Date Tested 07/09/2019
ALS ID 3664648

Test	Result	Unit	Method
Suspended Solids	6	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	12.3	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	2.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Trading as ALS
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Fax:+353 (0) 52 617 8103
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Report No: HYDR-568050419
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

For the Attention of: Hydro Environmental Services

Sample Reception 6 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Fax:+353 (0) 52 617 8103
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Report No: HYDR-568050419

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

Sample Type Water
Client ID 3/4 Croagh SW14
Date Tested 06/04/2019
ALS ID 3465051

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Ammonia	<0.02	mg/l NH3-N	P281
Chloride	13.4	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Orthophosphate	<0.02	mg/l P	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID 3/4 Croagh SW15
Date Tested 06/04/2019
ALS ID 3465052

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	12.9	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
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Report No: HYDR-568050419

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

Sample Type Water
Client ID 3/4 Croagh SW16
Date Tested 06/04/2019
ALS ID 3465053

Test	Result	Unit	Method
Suspended Solids	9	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	17.1	mg/l CL	P281
Nitrate	8.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID 3/4 Croagh SW17
Date Tested 06/04/2019
ALS ID 3465054

Test	Result	Unit	Method
Suspended Solids	5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	17.9	mg/l CL	P281
Nitrate	8.8	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
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Report No: HYDR-568050419

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

Sample Type Water
Client ID 3/4 Croagh SW18
Date Tested 06/04/2019
ALS ID 3465055

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	17.5	mg/l CL	P281
Nitrate	5.1	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID 3/4 Croagh SW19
Date Tested 06/04/2019
ALS ID 3465056

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	16.6	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
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Fax:+353 (0) 52 617 8103
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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: HYDR-569050419
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

For the Attention of: Hydro Environmental Services

Sample Reception 6 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Fax:+353 (0) 52 617 8103
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Report No: HYDR-569050419

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

Sample Type Water
Client ID 4/4 Croagh SW14
Date Tested 06/04/2019
ALS ID 3465057

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	13.4	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID 4/4 Croagh SW15
Date Tested 06/04/2019
ALS ID 3465058

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	12.7	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
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Report No: HYDR-569050419

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

Sample Type Water
Client ID 4/4 Croagh SW16
Date Tested 06/04/2019
ALS ID 3465059

Test	Result	Unit	Method
Suspended Solids	7	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	8	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	16.7	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID 4/4 Croagh SW17
Date Tested 06/04/2019
ALS ID 3465060

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	18.0	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
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Report No: HYDR-569050419

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/04/2019
Date Reported 15/04/2019
Order Number P1459

Sample Type Water
Client ID 4/4 Croagh SW18
Date Tested 06/04/2019
ALS ID 3465061

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	17.9	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.05	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID 4/4 Croagh SW19
Date Tested 06/04/2019
ALS ID 3465062

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<5	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	16.8	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.03	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
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Report No: HYDR-412200320

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 20/03/2020
Date Reported 01/04/2020
Order Number N/A

For the Attention of: Hydro Environmental Services

Sample Reception 3 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

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Report No: HYDR-412200320

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Date Received 20/03/2020
Date Reported 01/04/2020
Order Number N/A

Sample Type Water
Client ID Access Rd Sw1
Date Tested 20/03/2020
ALS ID 3931124

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	14.9	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Water
Client ID Access Rd Sw2
Date Tested 20/03/2020
ALS ID 3931125

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	13.2	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

ALS Life Sciences Ltd
Trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Tel: +353 (0) 52 617 8100
Fax:+353 (0) 52 617 8103
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Report No: HYDR-412200320

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

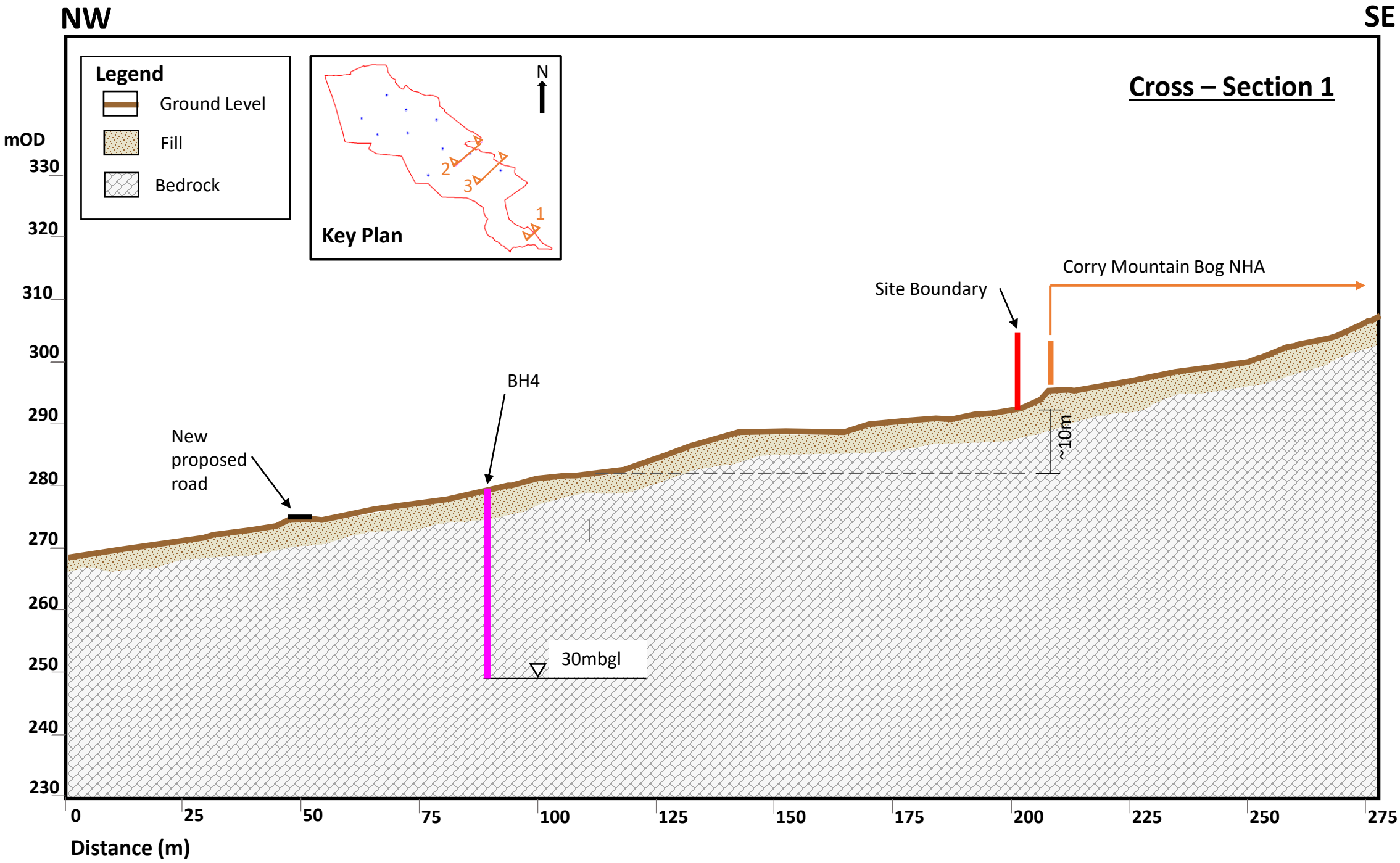
Date Received 20/03/2020
Date Reported 01/04/2020
Order Number N/A

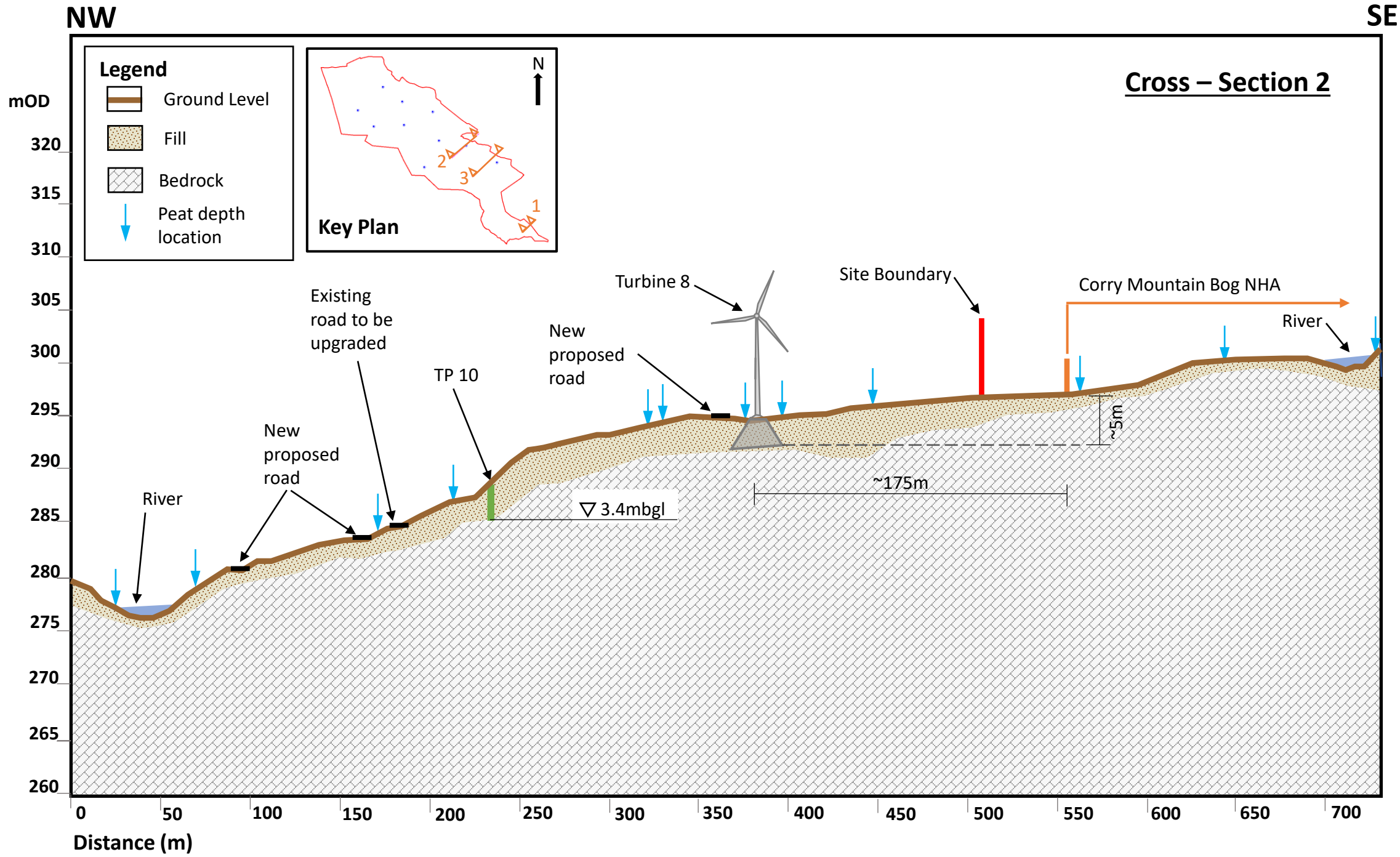
Sample Type Water
Client ID Access Rd Sw3
Date Tested 20/03/2020
ALS ID 3931126

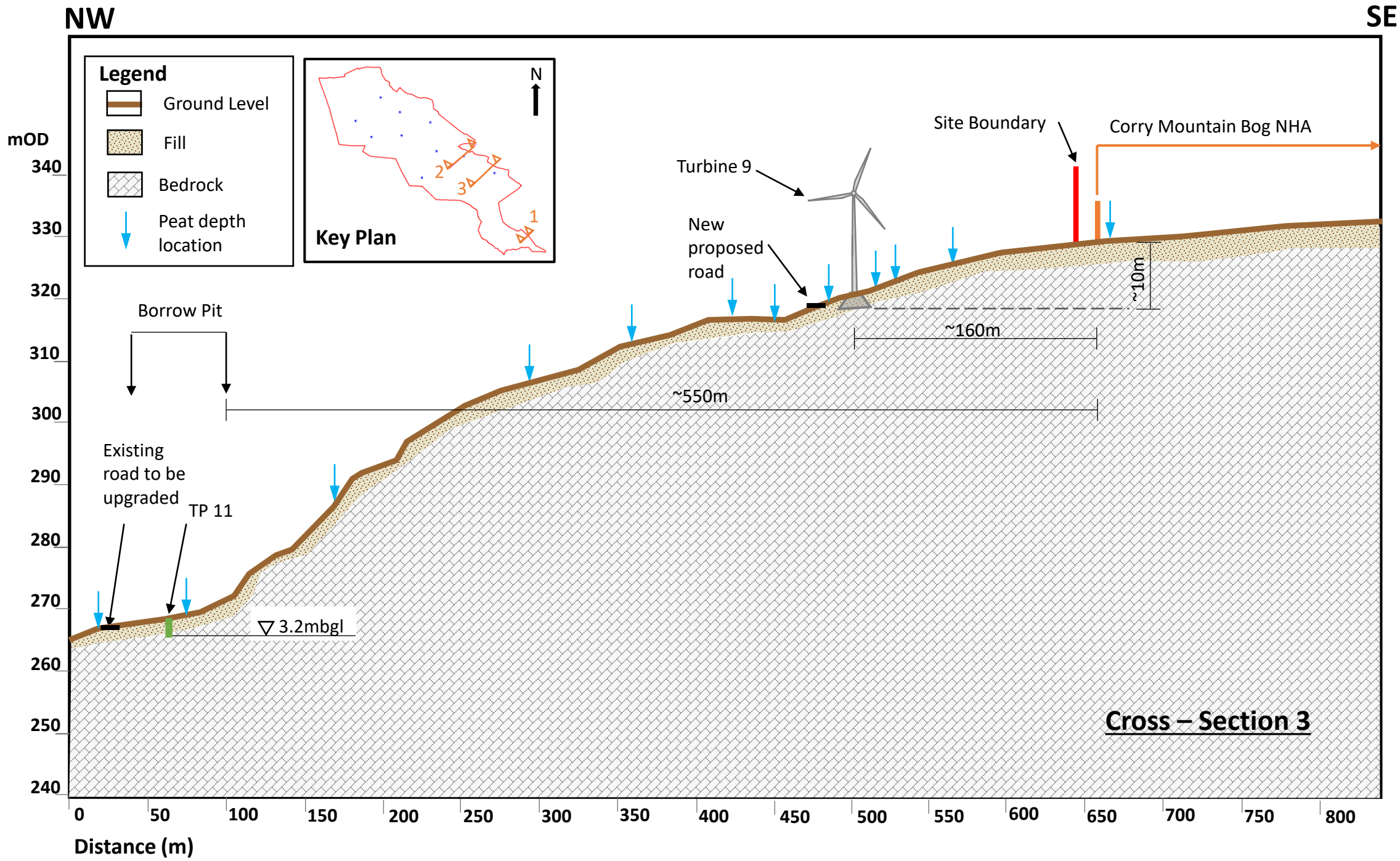
Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	15.4	mg/l CL	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager


NW
SE
Legend
Ground Level
Fill
Bedrock
N
Key Plan
1
2
3
Cross – Section 1
mOD
330
320
310
300
290
280
270
260
250
240
230
Corry Mountain Bog NHA
Site Boundary
BH4
New
proposed
road
~10m
30mbgl
0
25
50
75
100
125
150
175
200
225
250
275
Distance (m)


NW
SE
Cross – Section 2
Legend
Ground Level
Fill
Bedrock
Peat depth location
Key Plan
N
1
2
3
mOD
320
315
310
305
300
295
290
285
280
275
270
265
260
Turbine 8
Site Boundary
Corry Mountain Bog NHA
River
Existing road to be upgraded
New proposed road
TP 10
New proposed road
River
~5m
~175m
▽ 3.4mbgl
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Distance (m)


NW
SE
Legend
Ground Level
Fill
Bedrock
Peat depth location
Key Plan
N
1
2
3
mOD
340
330
320
310
300
290
280
270
260
250
240
Site Boundary
Corry Mountain Bog NHA
Turbine 9
New proposed road
~10m
~160m
Borrow Pit
~550m
Existing road to be upgraded
TP 11
3.2mbgl
Cross – Section 3
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
Distance (m)

Cover

CARBON CALCULATOR TOOL v . .

Help About...

Scottish Government and SEPA users only:


The Scottish Government
Application Status Control

Enter password

Sign in

Start Carbon Calculator

This tool calculates payback time for windfarm sited on peatlands using methods given in Nayak et al, 2008 (http://www.gov.scot/Publications/2008/06/25114657/0) and revised equations for GHG emissions (Nayak, D.R., Miller, D., Nolan, A., Smith, P. and Smith, J.U., 2010, Calculating carbon budgets of wind farms on Scottish peatland. Mires and Peat 4: Art. 9. Online: http://mires-and-peat.net/pages/volumes/map04/map0409.php

Admin

CARBON CALCULATOR TOOL v . . - APPLICATION STATUS CONTROL

Help

Reference Code: Search

Windfarm Name	Version	Methodology used for calculating emission factors	Status Date	Status
No data available in table				

PreviousNext

Selected:

Saved | Signed-off | Received | Consented | Refused | Withdrawn

Revert to original status

Start

CARBON CALCULATOR TOOL v . .

- Will the site be drained on construction of the windfarm?
- Is the soil at the site highly organic?
- Does windfarm construction require a significant amount of deforestation?
  i.e. is removal in excess of keyholing the turbines within the forest boundary?

If you already have an Application Reference, type it here (or paste it in the first box):

Search

New application

CoreInput

Core input data
1. Windfarm characteristics 2. Peatland 3. Bog plants 4. Forestry Plantation 5. Emission factors 6. Borrow pits 7. Foundations and hard-standing 8. Access tracks 9. Cable trenches 10. Additional peat 11. Improvement actions 12. Restoration after decomissioning 13. Methodology & application details
Forestry input data
Construction input data
Save ☐ Signed off for submission

Note: Results are only available once ALL data are correct and complete, and a new version will be created.

New app...

Ref: UW4P-GOM1-F0UM v

MENU≡

Help

Core input data | Forestry input data | Construction input data

Windfarm characteristics Page 1 of 12

Expected values	Minimum	Maximum
Dimensions		
Number of Turbines: 10		
Chapter 4 - Description	10	10
Duration of consent (years): 30		
Chapter 4 - Description	25	30
Performance		
Power rating of 1 turbine (MW): 4.8		
Chapter 4 - Description	4.8	4.8

Payback Time

Payback Time

Payback Time - ChartsInput Data

1. Windfarm CO2 emission saving over...	Exp.	Min.	Max.
...coal-fired electricity generation (t CO2 / yr)	1,354	1,315	1,393
...grid-mix of electricity generation (t CO2 / yr)	373	363	384
...fossil fuel-mix of electricity generation (t CO2 / yr)	662	643	681
Energy output from windfarm over lifetime (MWh)	44,150	35,741	45,412

Total CO2 losses due to wind farm (tCO2 eq.)	Exp.	Min.	Max.
2. Losses due to turbine life (eg. manufacture, construction, decomissioning)	41,595	41,595	41,595
3. Losses due to backup	28,382	23,652	28,382
4. Lossess due to reduced carbon fixing potential	1,401	569	2,624
5. Losses from soil organic matter	29,232	13,481	74,910
6. Losses due to DOC & POC leaching	0	0	0
7. Losses due to felling forestry	21,463	15,785	24,095
Total losses of carbon dioxide	122,074	95,082	171,606

8. Total CO2 gains due to improvement of site (t CO2 eq.)	Exp.	Min.	Max.
8a. Change in emissions due to improvement of degraded bogs	0	0	0
8b. Change in emissions due to improvement of felled forestry	0	0	0
8c. Change in emissions due to restoration of peat from borrow pits	0	0	0
8d. Change in emissions due to removal of drainage from foundations & hardstanding	0	0	0
Total change in emissions due to improvements	0	0	0

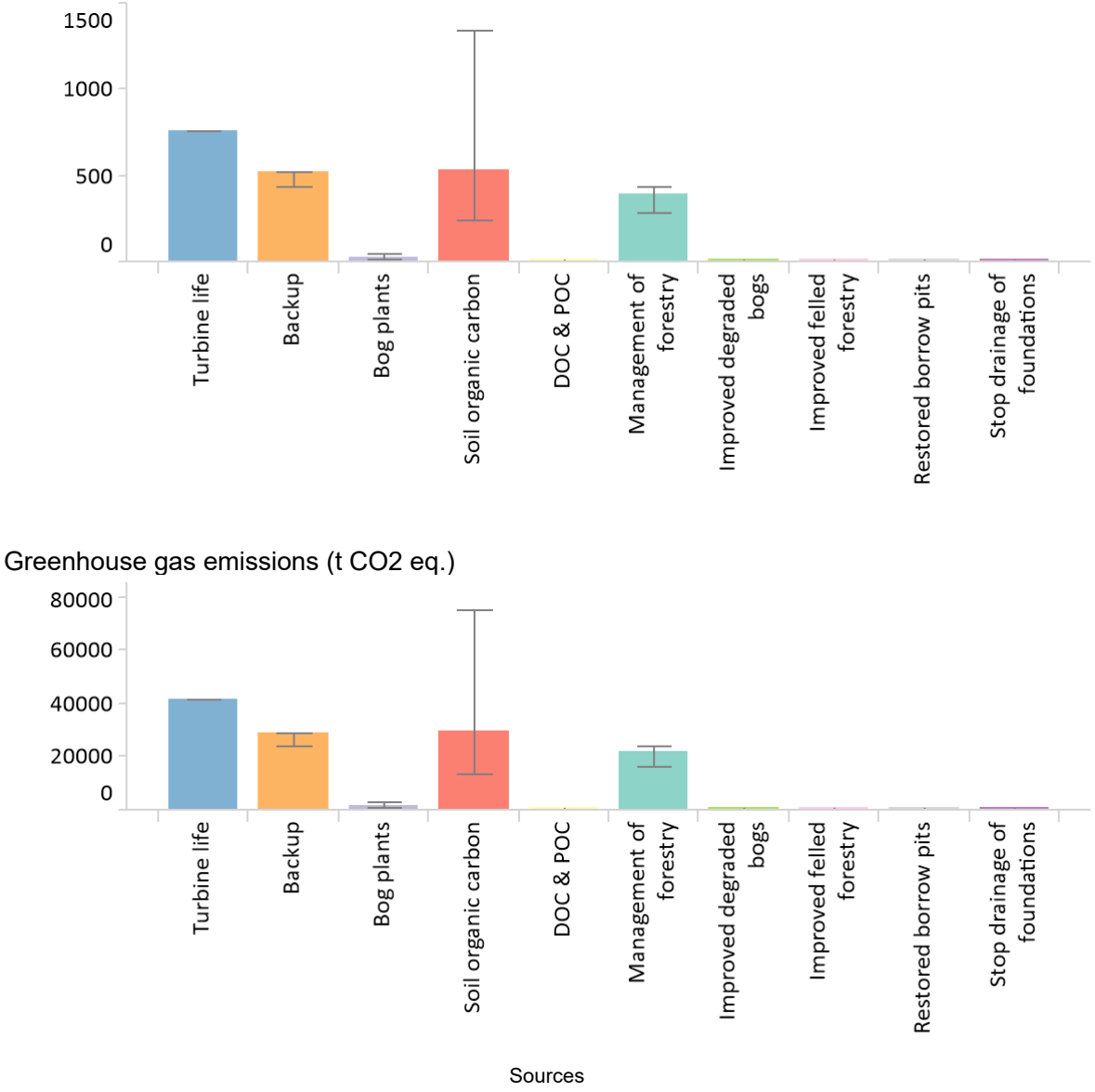
RESULTS	Exp.	Min.	Max.
Net emissions of carbon dioxide (t CO2 eq.)	122,074	95,082	171,606
Carbon Payback Time			
...coal-fired electricity generation (years)	90.2	68.3	130.5
...grid-mix of electricity generation (years)	327.1	247.7	473.4
...fossil fuel-mix of electricity generation (years)	184.3	139.6	266.7
Ratio of soil carbon loss to gain by restoration (not used in Scottish applications)	No gains!	No gains!	No gains!

Payback Time - Charts

Payback Time

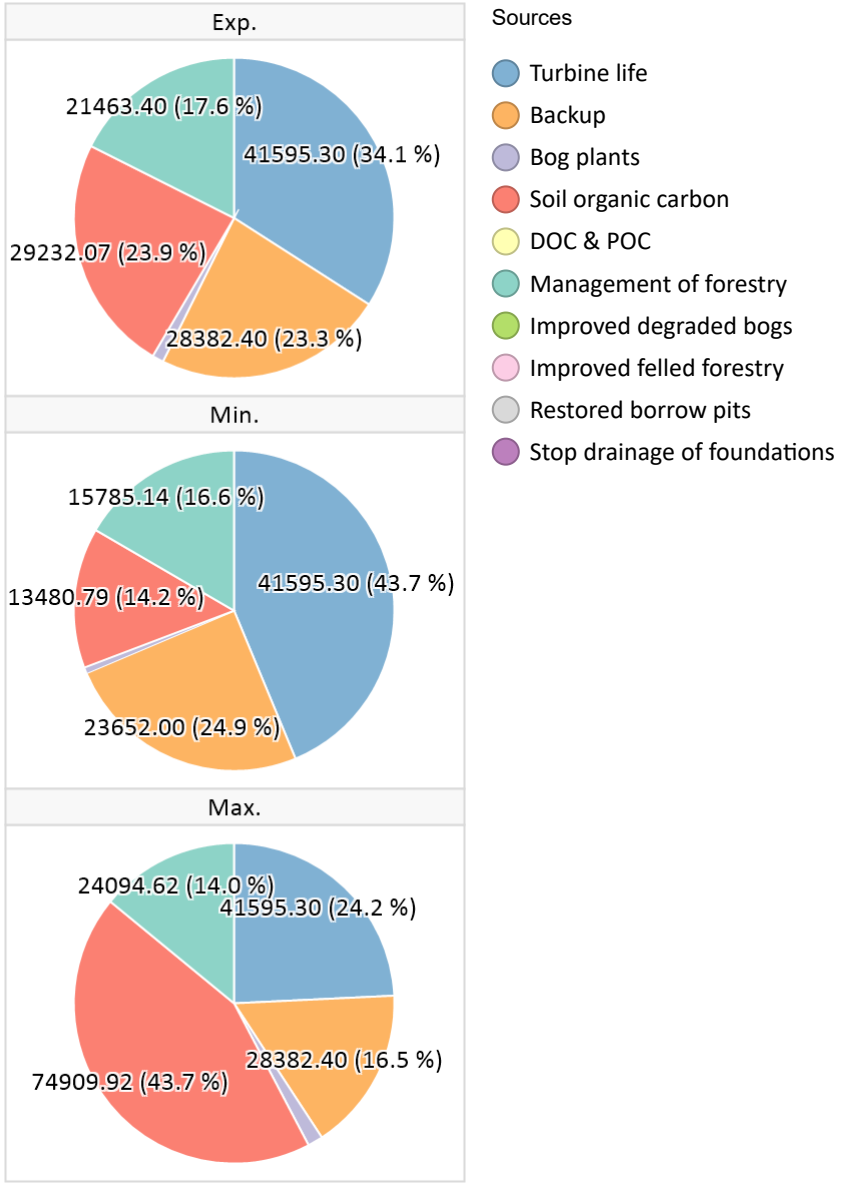
Payback Time - ChartsInput Data

Carbon payback time (months) using fossil-fuel mix as conterfactual



Greenhouse gas emissions (t CO2 eq.)

Proportions of greenhouse gas emissions from different sources



Print this page

Carbon Calculator v1.6.0

Croagh Wind Farm Location: 54.157377 -8.22834

Coillte Renewable Energy

Core input data

Input data	Expected value	Minimum value	Maximum value	Source of data
Windfarm characteristics				
Dimensions				
No. of turbines	10	10	10	Chapter 4 - Description
Duration of consent (years)	30	25	30	Chapter 4 - Description
Performance				
Power rating of 1 turbine (MW)	4.8	4.8	4.8	Chapter 4 - Description
Capacity factor	0.35	0.34	0.36	Chapter 4 - Description
Backup				
Fraction of output to backup (%)	5	5	5	SNH Calculator Guidance
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Total CO2 emission from turbine life (tCO2 MW^{-1}) (eg. manufacture, construction, decommissioning)	Calculate wrt installed capacity	Calculate wrt installed capacity	Calculate wrt installed capacity	
Characteristics of peatland before windfarm development				
Type of peatland	Acid bog	Acid bog	Acid bog	Chapter 6 - Biodiversity
Average annual air temperature at site (°C)	9.3	5.7	12.9	Chapter 10 Air & Climate
Average depth of peat at site (m)	2.1	1.6	2.7	Chapter 8 - Land, Soils & Geology
C Content of dry peat (% by weight)	55	50	60	Default Value Used
Average extent of drainage around drainage features at site (m)	15	10	20	Chapter 9 - Water
Average water table depth at site (m)	0.5	0.1	1	IDL - Boreholes
Dry soil bulk density (g cm^{-3})	0.1	0.09	0.11	Default Value Used

5. Loss of soil CO2 (a, b)

Emissions due to loss of soil organic carbon
Loss of C stored in peatland is estimated from % site lost by peat removal (table 5a), CO2 loss from removed peat (table 5b), % site affected by drainage (table 5c), and the CO2 loss from drained peat (table 5d)

Volume of Peat Removed
% site lost by peat removal is estimated from peat removed in borrow pits, turbine foundations, hard-standing and access tracks. If peat is removed for any other reason, this must be added in as additional peat excavated in the core input data entry

5. Loss of soil C02

	Exp.	Min.
CO2 loss from removed peat (t CO2 equiv.)	24150.72	13480.79
CO2 loss from drained peat (t CO2 equiv.)	5081.35	0
RESULTS		
Total CO2 loss from peat (removed + drained) (t CO2 equiv.)	29232.07	13480.79
Additional CO2 payback time of windfarm due to loss of soil C...		
...coal-fired electricity generation (months)	259.08	122.99
...grid-mix of electricity generation (months)	939.97	446.23
...fossil fuel - mix of electricity generation (months)	529.68	251.45

CO_2 loss from removed peats
If peat is treated in such a way that it is permanently restored, so that less than 100% of the C is lost to the atmosphere, a lower percentage can be entered in cell C10

5b. CO2 loss from removed peat

	Exp.	Min.
CO2 loss from removed peat (t CO2)	32730.80	20192.06
CO2 loss from undrained peat left in situ (t CO2)	8580.08	6711.27
RESULTS		
CO2 loss atributable to peat removal only (t CO2)	24150.72	13480.79

5a. Volume of peat removed

	Exp.
Peat removed from borrow pits	
Area of land lost in borrow pits (m2)	25000
Volume of peat removed from borrow pits (m3)	12500
Peat removed from turbine foundations	
Area of land lost in foundation (m2)	4000
Volume of peat removed from foundation area (m3)	8000
Peat removed from hard-standing	
Area of land lost in hard-standing (m2)	19250
Volume of peat removed from hard-standing area (m3)	38500
Peat removed from access tracks	
Area of land lost in floating roads (m2)	6000
Volume of peat removed from floating roads (m3)	6000
Area of land lost in excavated roads (m2)	35400
Volume of peat removed from excavated roads (m3)	70800
Area of land lost in rock-filled roads (m2)	0
Volume of peat removed from rock-filled roads (m3)	0
Total area of land lost in access tracks (m2)	41400
Total volume of peat removed due to access tracks (m3)	76800
RESULTS	
Total area of land lost due to windfarm construction (m2)	102900
Total volume of peat removed due to windfarm construction (m3)	162300

5. Loss of soil CO2 (c,d,e)

Payback Time
Payback Time - ChartsInput Data

Volume of peat drained
Extent of site affected by drainage is calculated assuming an average extent of drainage around each drainage feature as given in the input data.

CO_2 loss due to drainage
Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new

5c. Volume of peat drained

	Exp.
Total area affected by drainage around borrow pits (m2)	11400
Total volume affected by drainage around borrow pits (m3)	2850
Peat affected by drainage around turbine foundation and hardstanding	
Total area affected by drainage of foundation and hardstanding area (m2)	48000
Total volume affected by drainage of foundation and hardstanding area (m3)	48000
Peat affected by drainage of access tracks	
Total area affected by drainage of access track(m2)	213000
Total volume affected by drainage of access track(m3)	186000
Peat affected by drainage of cable trenches	
Total area affected by drainage of cable trenches(m2)	0
Total volume affected by drainage of cable trneches(m3)	0
Drainage around additional peat excavated	
Total area affected by drainage (m2)	6827.6
Total volume affected by drainage (m3)	13655.2
RESULTS	

5d. CO2 loss from drained peat

	Exp
Calculations of C Loss from Drained Land if Site is NOT Restored after Decomissioning	
Total GHG emissions from Drained Land (t CO2 equiv.)	5051
Total GHG emissions from Undrained Land (t CO2 equiv.)	4543
Calculations of C Loss from Drained Land if Site IS Restored after Decomissioning	
Losses if Land is Drained	
CH4 emissions from drained land (t CO2 equiv.)	-13
CO2 emissions from drained land (t CO2)	260
Total GHG emissions from Drained Land (t CO2 equiv.)	5051
Losses if Land is Undrained	
CH4 emissions from undrained land (t CO2 equiv.)	-11
CO2 emissions from undrained land (t CO2)	2339
Total GHG emissions from Undrained Land (t CO2 equiv.)	4543
RESULTS	
Total GHG emissions due to drainage (t CO2 equiv.)	508

Emission rates from soils
Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included

5e. Emission rates from soils

	Exp.	Min.	Max.
Calculations following IPCC default methodology			
Flooded period (days/year)	178	178	178
Annual rate of methane emission (t CH4-C/ha year)	0.04	0.04	0.04
Annual rate of carbon dioxide emission (t CO2/ha year)	35.2	35.2	35.2

7. Forestry CO2 loss

Payback Time
Payback Time - ChartsInput Data

CO_2 loss from forests - calculation using detailed management information

Forest carbon calculator (Perks et al, 2009)

Total potential carbon squestration loss due to felling of forestry for the wind farm (t CO2)	
Total emissions due to cleared land (t CO2)	
Emissions due to harvesting operations (t CO2)	
Fossil fuel equivalent saving from use of felled forestry as biofuel (t CO2)	
Fossil fuel equivalent saving from use of replanted forestry as biofuel (t CO2)	
RESULTS	
Total carbon loss associated with forest management(t CO2)	

Emissions due to forest felling - calculation using simple management data

Emissions due to forestry felling are calculated from the reduced carbon sequestered per crop rotation. If the forestry was due to be removed before the planned development, this C loss is not attributable to the wind farm and so the area of forestry to be felled should be entered as zero

	Exp.	Min.	Max.
Area of forestry plantation to be felled (ha)	54.2	49.2	59.2
Carbon sequestered (t C ha-1 yr-1)	3.6	3.5	3.7
Lifetime of windfarm (years)	30	25	30
Carbon sequestered over the lifetime of the windfarm (t C ha-1)	108	87.5	111
RESULTS			
Total carbon loss due to felling of forestry (t CO2)	21463.4	15785.14	24094.62
Additional CO2 payback time of windfarm due to management of forestry			
...coal-fired electricity generation (months)	190.23	144.02	207.62
...grid-mix of electricity generation (months)	690.16	522.51	753.25
...fossil fuel - mix of electricity generation (months)	388.91	294.44	424.46

8. CO2 gain - site improvement

Payback Time
Payback Time - ChartsInput Data

Gains due to site improvement
Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been thoroughly tested against experimental data (see Nayak et al, 2008 -

Degraded Bog

	Exp.
1. Description of site	
Area to be improved (ha)	0
Depth of peat above water table before improvement (m)	0
Depth of peat above water table after improvement (m)	0
2. Losses with improvement	
Improved period (years)	0
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.496
CH4 emissions from improved land (t CO2 equiv.)	0
Selected annual rate of carbone dioxide emissions (t CO2 ha-1 yr-1)	0.349
CO2 emissions from improved land (t CO2 equiv.)	0
Total GHG emissions from improved land (t CO2 eqiv.)	0

Felled Forestry

	Exp.	Min.
1. Description of site		
Area to be improved (ha)	0	
Depth of peat above water table before improvement (m)	0	
Depth of peat above water table after improvement (m)	0	
2. Losses with improvement		
Improved period (years)	0	
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.496	0.4
CH4 emissions from improved land (t CO2 equiv.)	0	
Selected annual rate of carbone dioxide emissions (t CO2 ha-1 yr-1)	0.349	-0.6
CO2 emissions from improved land (t CO2 equiv.)	0	
Total GHG emissions from improved land (t CO2 eqiv.)	0	

Borrow Pits

	Exp.
1. Description of site	
Area to be improved (ha)	0
Depth of peat above water table before improvement (m)	0
Depth of peat above water table after improvement (m)	0
2. Losses with improvement	
Improved period (years)	0
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.496
CH4 emissions from improved land (t CO2 equiv.)	0
Selected annual rate of carbone dioxide emissions (t CO2 ha-1 yr-1)	0.349
CO2 emissions from improved land (t CO2 equiv.)	0
Total GHG emissions from improved land (t CO2 eqiv.)	0

Foundations & Hardstanding

	Exp.	Min.
1. Description of site		
Area to be improved (ha)	0	
Depth of peat above water table before improvement (m)	0	
Depth of peat above water table after improvement (m)	0	
2. Losses with improvement		
Improved period (years)	30	
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.496	0.4
CH4 emissions from improved land (t CO2 equiv.)	0	
Selected annual rate of carbone dioxide emissions (t CO2 ha-1 yr-1)	0.349	-0.6
CO2 emissions from improved land (t CO2 equiv.)	0	
Total GHG emissions from improved land (t CO2 eqiv.)	0	

3. CO2 loss backup

Emissions due to backup power generation
CO2 loss due to back up is calculated from the extra capacity required for backup of the windfarm given in the input data.

Wind generated electricity is inherently variable, providing unique challenges to the electricity generating industry for provision of a supply to meet consumer demand (Netz, 2004). Backup power is required to accompany wind generation to stabilise the supply to the consumer. This backup power will usually be obtained from a fossil fuel source. At a high level of wind power penetration in the overall generating mix, and with current grid management techniques, the capacity for fossil fuel backup may become strained because it is being used to balance the fluctuating consumer demand with a variable and highly unpredictable output from wind turbines (White, 2007). The Carbon Trust (Carbon Trust/DTI, 2004) concluded that increasing levels of intermittent generation do not present major technical issues at the percentages of renewables expected by 2010 and 2020, but the UK renewables target at the time of that report was only 20%. When national reliance on wind power is low (less than ~20%), the additional fossil fuel generated power requirement can be considered to be insignificant and may be obtained from within the spare generating capacity of other power sectors (Dale et al, 2004). However, as the national supply from wind power increases above 20%, without improvements in grid management techniques, emissions due to backup power generation may become more significant. The extra capacity needed for backup power generation is currently estimated to be 5% of the rated capacity of the wind plant if wind power contributes more than 20% to the national grid (Dale et al 2004). Moving towards the SG target of 50% electricity generation from renewable sources, more short-term capacity may be required in terms of pumped-storage hydro-generated power, or a better mix of offshore and onshore wind generating capacity. Grid management techniques are anticipated to reduce this extra capacity, with improved demand side management, smart meters, grid reinforcement and other developments. However, given current grid management techniques, it is suggested that 5% extra capacity should be assumed for backup power generation if wind power contributes more than 20% to the national grid. At lower contributions, the extra capacity required for backup should be assumed to be zero. These assumptions should be revisited as technology improves.

Assumption: Backup assumed to be by fossil-fuel-mix of electricity generation. Note that hydroelectricity may also be used for backup, so this assumption may make the value

	Exp.	Min.	Max.
Reserve energy (MWh/yr)	21,024	21,024	21,024
Annual emissions due to backup from fossil fuel-mix of electricity generation (tCO2/yr)	946	946	946
RESULTS			
Total emissions due to backup from fossil fuel-mix of electricity generation (tCO2)	28,382	23,652	28,382

1. CO2 emission saving

Payback Time
Payback Time - ChartsInput Data

Emissions due to turbine life
The carbon payback time of the windfarm due to turbine life (eg. manufacture, construction, decomissioning) is calculated by comparing the emissions due to turbine life with carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

Capacity factor calculated from forestry data

Area name	Value type	Capacity factor (%)	Wind speed ratio	Average site windspeed (m/

Capacity factor - Direct input

	Exp.	Min.	Max.
Capacity factor (%)	0.4	0.3	0.4

	Exp.	Min.	Max.
Annual energy output from windfarm (MW/yr)			
RESULTS			
Emissions saving over coal-fired electricity generatio…	1,354	1,315	1,393
Emissions saving over grid-mix of electricity generati…	373	363	384
Emissions saving over fossil fuel - mix of electricity g…	662	643	681

2. CO2 loss turbine life

Emissions due to turbine life
The carbon payback time of the windfarm due to turbine life (eg. manufacture, construction, decomissioning) is calculated by comparing the emissions due to turbine life with carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

Calculation of emissions with relation to installed capacity

	Exp.	Mi
Emissions due to turbine frome energy output (t CO2)	4017	
Emissions due to cement used in construction (t CO2)	1422	

Direct input of emissions due to turbine life

	Exp.	Min.
Emissions due to turbine life (tCO2/windfarm)		

RESULTS

	Exp.	Min.	Max.
Losses due to turbine life (manufacture, construction, etc.) (t CO2)	41595	41595	41595
Additional CO2 payback time of windfarm due to turbine life			
...coal-fired electricity generation (months)	369	380	358
...grid-mix of electricity generation (months)	1338	1377	1300
...fossil fuel - mix of electricity generation (months)	754	776	733

4. Loss CO2 fixing pot.

Emissions due to loss of bog plants
Annual C fixation by the site is calculated by multiplying area of the windfarm by the annual C accumulation due to bog plant fixation.

	Exp.	Min.	Max.
Area where carbon accumulation by bog plants is lost (ha)	38.21	25.86	53.01
Total loss of carbon accumulation up to time of restoration (tCO2 eq./ha)	37	22	50
RESULTS			
Total loss of carbon fixation by plants at the site (t CO2)	1401	569	2624
Additional CO2 payback time of windfarm due to loss of CO2 fixing potential			
...coal-fired electricity generation (months)	12	5	23
...grid-mix of electricity generation (months)	45	19	82
...fossil fuel - mix of electricity generation (months)	25	11	46

6. CO2 loss DOC & POC

Emissions due to loss of DOC and POC

Note, CO2 losses from DOC and POC are calculated using a simple approach derived from generic estimates of the percentage of the total CO2 loss that is due to DOC or POC leaching.

	Exp.	Min.	Max.
Gross CO2 loss from restored drained land (t CO2)	0.00	0.00	0.00
Gross CH4 loss from restored drained land (t CO2 equiv.)	0.00	0.00	0.00
Gross CO2 loss from improved land (t CO2)	0.00	0.00	0.00
Gross CH4 loss from improved land (t CO2 equiv.)	0.00	0.00	0.00
Total gaseous loss of C (t C)	0.00	0.00	0.00
Total C loss as DOC (t C)	0.00	0.00	0.00
Total C loss as POC (t C)	0.00	0.00	0.00
RESULTS			
Total CO2 loss due to DOC leaching (t CO2)	0.00	0.00	0.00
Total CO2 loss due to POC leaching (t CO2)	0.00	0.00	0.00
Total CO2 loss due to DOC & POC leaching (t CO2)	0.00	0.00	0.00
Additional CO2 payback time of windfarm due to DOC & POC			
...coal-fired electricity generation (months)	0	0	0
...grid-mix of electricity generation (months)	0	0	0
...fossil fuel - mix of electricity generation (months)	0	0	0

GLOSSARY OF ACOUSTIC TERMINOLOGY

A variety of acoustic parameters and terminology are used throughout this chapter. Significant definitions are identified at this stage to inform the reader.

A – Weighting	The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.
Background Noise	The noise level rarely fallen below in any given location over any given time period, often classed according to day time, evening or night time periods. The LA90,10min is the parameter that is used to define the background noise level in this instance. LA90 is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
dB (decibel)	The unit normally employed to measure the magnitude of sound. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB(A)	An 'A-weighted decibel' – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A – Weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hub Height Wind Speed	The wind speed at the centre of the turbine rotor.
Hertz (Hz)	The unit of sound frequency in cycles per second.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the LAeq value is to either the LAF10 or LAF90 value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
L_{den}	Refers to the LAeq noise levels over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator.

GLOSSARY OF ACOUSTIC TERMINOLOGY (Continued)

Low Frequency Noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
Noise	Sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other

	area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
Pascal (Pa)	Pascal is a unit of pressure and so sound pressures are measured in Pascals.
Sound Power Level (L_W)	The sound power level radiated by a source is defined as: $L_W = 10 \times \log_{10}(W/W_o)$ dB. Where W is the acoustic power of the source in Watts (W) and W_o is a reference sound power chosen in air to be 10^{-12}W.
Sound Pressure Level (L_p)	The sound pressure level at a point is defined: $L_p = 20 \times \log_{10}(P/P_o)$ dB. Where P is the sound pressure and P_o is a reference pressure for propagation of sound in air and has a value of 2×10^{-5}Pa.
Tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.
10 Minute Average Wind Speed (m/s)	The wind speed measured by an anemometer at a specified height above ground level, averaged over a 10-minute period.
Wind Shear	The increase of wind speed with height above ground.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 02 May 2018 **Certificate Number: UCRT18/1474**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL			
Order No.	ANV MS DEMO			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00620867
	Rion	Firmware		1.8
	Rion	Pre Amplifier	NH-25	20927
	Rion	Microphone	UC-59	03706
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49 *Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	30 April 2018	ANV Job No.	UKAS18/04279	
Date Calibrated	02 May 2018			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

CERTIFICATE OF CALIBRATION

Certificate Number	
UCRT18/1474	
UKAS Accredited Calibration Laboratory No. 0653	Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	05 April 2018		
Calibrator cert. number	UCRT18/1348		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.98	dB	Calibration reference sound pressure level
Calibrator frequency	1001.90	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	21.32	22.64	± 0.30	°C
Humidity	42.3	42.7	± 3.00	%RH
Ambient Pressure	99.04	99.05	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.1	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.0	dB	UR	15.2	dB	UR	20.9	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel R 1

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 20 November 2018 **Certificate Number: UCRT18/2167**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL
Order No.	ANV MS HIRE
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00620878
	Rion	Firmware		1.9
	Rion	Pre Amplifier	NH-25	10188
	Rion	Microphone	UC-59	02536
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class	1
Test Procedure	TP 2.SLM 61672-3 TPS-49
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.
Type Approved to IEC 61672-1:2002	YES Approval Number 21.21 / 13.02
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003
Date Received	19 November 2018 ANV Job No. UKAS18/11722
Date Calibrated	20 November 2018

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	14 November 2017	UCRT17/2031	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT18/2167

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	07 November 2018		
Calibrator cert. number	UCRT18/2124		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.99	dB	Calibration reference sound pressure level
Calibrator frequency	1001.96	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	23.37	22.69	± 0.30	°C
Humidity	39.4	39.3	± 3.00	%RH
Ambient Pressure	99.88	99.80	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	14.0	dB	UR	18.0	dB	UR	23.6	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: Ben Giles

R 2

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 03 July 2018

Certificate Number: UCRT18/1672

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL
Order No.	ANV MS HIRE
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00710288
	Rion	Firmware		1.9
	Rion	Pre Amplifier	NH-25	10282
	Rion	Microphone	UC-59	02726
	Brüel & Kjær	Calibrator	4231	3002998
		Calibrator adaptor type if applicable		UC 0210

Performance Class	1		
Test Procedure	TP 2.SLM 61672-3 TPS-49		
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.		
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003		
Date Received	02 July 2018	ANV Job No.	UKAS18/07414
Date Calibrated	03 July 2018		

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	14 July 2017	UCRT17/1593	0653

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CERTIFICATE OF CALIBRATION

Certificate Number	
UCRT18/1672	
UKAS Accredited Calibration Laboratory No. 0653	Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	UC 0210		
Calibrator cal. date	11 June 2018		
Calibrator cert. number	UCRT18/1595		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.13	dB	Calibration reference sound pressure level
Calibrator frequency	999.96	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	24.07	24.58	± 0.30	°C
Humidity	36.6	38.6	± 3.00	%RH
Ambient Pressure	100.87	100.83	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.1	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.9	dB	UR	16.8	dB	UR	22.5	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel R 2

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 18 June 2018

Certificate Number: UCRT18/1626

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL
Order No.	ANV MS HIRE
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NL-52	00732075
Rion	Firmware		1.8
Rion	Pre Amplifier	NH-25	32103
Rion	Microphone	UC-59	05632
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2002 YES Approval Number 21.21 / 13.02

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003

Date Received 13 June 2018 ANV Job No. UKAS18/06374

Date Calibrated 18 June 2018

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate

Dated	*Certificate No.*	*Laboratory*
03 July 2017	UCRT17/1554	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT18/1626

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	11 June 2018		
Calibrator cert. number	UCRT18/1592		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.02	dB	Calibration reference sound pressure level
Calibrator frequency	1001.95	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	23.20	22.87	± 0.30	°C
Humidity	39.7	37.9	± 3.00	%RH
Ambient Pressure	100.78	100.80	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.1	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise	This test is currently not performed by this Lab.		
Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	13.7	dB	UR	17.6	dB	UR	23.6	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel

R 1

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 18 December 2018 **Certificate Number: UCRT18/2250**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL
Order No.	ANV MS HIRE
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00732145
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	32173
	Rion	Microphone	UC-59	10449
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	17 December 2018	ANV Job No.	UKAS18/12768	
Date Calibrated	18 December 2018			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	18 January 2018	UCRT18/1051	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number UCRT18/2250

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	04 December 2018		
Calibrator cert. number	UCRT18/2206		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.99	dB	Calibration reference sound pressure level
Calibrator frequency	1001.87	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15

Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	23.36	23.18	± 0.40	°C
Humidity	41.7	47.1	± 3.00	%RH
Ambient Pressure	99.42	99.34	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.1	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.1	dB	UR	15.1	dB	UR	21.1	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel

R 1

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 05 October 2018 **Certificate Number: UCRT18/2021**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL

Order No.	ANV MS HIRE			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00976222
	Rion	Firmware		1.9
	Rion	Pre Amplifier	NH-25	76339
	Rion	Microphone	UC-59	12155
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	28 September 2018	ANV Job No.	UKAS18/09611	
Date Calibrated	05 October 2018			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	29 November 2017	UCRT17/2063	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT18/2021

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	03 October 2018		
Calibrator cert. number	UCRT18/2010		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.01	dB	Calibration reference sound pressure level
Calibrator frequency	1001.98	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	23.70	23.90	± 0.40 °C
Humidity	48.9	47.8	± 3.00 %RH
Ambient Pressure	100.46	100.38	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	93.9	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.2	dB	UR	15.2	dB	UR	21.2	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel R 1

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 10 October 2018 **Certificate Number: UCRT18/2033**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	ANV Measurement Systems Beaufort Court 17 Roebuck Way Milton Keynes MK5 8HL

Order No.	ANV MS HIRE			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	01021277
	Rion	Firmware		1.9
	Rion	Pre Amplifier	NH-25	21319
	Rion	Microphone	UC-59	07020
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	09 October 2018	ANV Job No.	UKAS18/10637	
Date Calibrated	10 October 2018			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	22 May 2018	UCRT18/1529	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT18/2033

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	03 October 2018		
Calibrator cert. number	UCRT18/2010		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.01	dB	Calibration reference sound pressure level
Calibrator frequency	1001.98	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	21.74	22.18	± 0.30	°C
Humidity	45.6	45.2	± 3.00	%RH
Ambient Pressure	100.43	100.43	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise	This test is currently not performed by this Lab.		
Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.1	dB	UR	15.8	dB	UR	22.2	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: B. Bogdan

R 2

Additional Comments

None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 20 April 2018 **Certificate Number: UCRT18/1437**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	AWN Consulting Limited The Tecpro Building Clonshaugh Business and Technology Park Dublin 17 Ireland D17 NX50
Order No.	
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00186671
	Rion	Firmware		1.9
	Rion	Pre Amplifier	NH-25	76821
	Rion	Microphone	UC-59	12817
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	20 April 2018	ANV Job No.	UKAS18/04261	
Date Calibrated	20 April 2018			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

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CERTIFICATE OF CALIBRATION

Certificate Number	
UCRT18/1437	
UKAS Accredited Calibration Laboratory No. 0653	Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52	
SLM instruction manual ref / issue		11-03	
SLM instruction manual source		Manufacturer	
Internet download date if applicable		N/A	
Case corrections available		Yes	
Uncertainties of case corrections		Yes	
Source of case data		Manufacturer	
Wind screen corrections available		Yes	
Uncertainties of wind screen corrections		Yes	
Source of wind screen data		Manufacturer	
Mic pressure to free field corrections		Yes	
Uncertainties of Mic to F.F. corrections		Yes	
Source of Mic to F.F. corrections		Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002		Yes	
Specified or equivalent Calibrator		Specified	
Customer or Lab Calibrator		Lab Calibrator	
Calibrator adaptor type if applicable		NC-74-002	
Calibrator cal. date		05 April 2018	
Calibrator cert. number		UCRT18/1348	
Calibrator cal cert issued by		0653	
Calibrator SPL @ STP		93.98 dB	Calibration reference sound pressure level
Calibrator frequency		1001.90 Hz	Calibration check frequency
Reference level range		25 - 130 dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	23.57	23.78	± 0.30 °C
Humidity	47.7	45.5	± 3.00 %RH
Ambient Pressure	101.35	101.36	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.1 dB		Adjusted indicated level	94.0 dB
The uncertainty of the associated calibrator supplied with the sound level meter =				0.10 dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.5	dB	UR	16.6	dB	UR	22.3	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: B. Bogdan R 2

Additional Comments
None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 20 April 2018

Certificate Number: UCRT18/1432

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	AWN Consulting Limited The Tecpro Building Clonshaugh Business and Technology Park Dublin 17 Ireland D17 NX5D
Order No.	
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00186667
	Rion	Firmware		1.9
	Rion	Pre Amplifier	NH-25	76817
	Rion	Microphone	UC-59	12812
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	20 April 2018	ANV Job No.	UKAS18/04261	
Date Calibrated	20 April 2018			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

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CERTIFICATE OF CALIBRATION

Certificate Number
UCRT18/1432
Page 2 of 2 Pages

UKAS Accredited Calibration Laboratory No. 0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	05 April 2018		
Calibrator cert. number	UCRT18/1348		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.98	dB	Calibration reference sound pressure level
Calibrator frequency	1001.90	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.18	22.93	± 0.30 °C
Humidity	53.1	51.5	± 3.00 %RH
Ambient Pressure	101.32	101.34	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.7	dB	UR	16.7	dB	UR	22.7	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel R 1

Additional Comments
None

Noise Modelling Assumptions

Prediction calculations for turbine noise have been conducted in accordance with ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, 1996. Guidance in terms of the calculation settings has been obtained from the Institute of Acoustics (IoA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IoA GPG) and its associated supplementary guidance notes. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation)

Noise Calculations have been conducted using a source height corresponding to the hub height of the proposed turbines, a receiver height of 4m and an assumed ground factor of G=0.5.

Geometrical Divergence This term relates to the spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log(d) + 11$$

where d = distance from the source

A wind turbine may be considered as a point source beyond a distance corresponding to one rotor diameter.

Atmospheric Adsorption Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies.

In accordance with the guidance set out in the IoA GPG for calculations, a temperature of 10°C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.

Barrier Attenuation The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency

spectrum of the noise. The barrier attenuations predicted by the ISO9613 model have been shown to be significantly greater than that measured in practice under down wind conditions.

Table A4.1 Garvagh Glebe Turbine Co-ordinates

Co-ordinates (ITM)	
Easting	Northing
585,325	823,856
585,489	823,503
585,898	823,511
586,455	823,270
586,945	823,082
586,093	823,851
586,410	823,661
587,615	821,468
587,605	820,977
588,092	821,137
588,338	820,904
588,657	820,619
587,125	822,745

Table A4.1 Black Banks 1 Turbine Co-ordinates

Co-ordinates (ITM)	
Easting	Northing
586,790	822,394
586,971	822,267
586,996	821,977
587,178	821,893

Table A4.1 Black Banks 2 Turbine Co-ordinates

Co-ordinates (ITM)	
Easting	**Northing**
586,427	822,110
586,609	822,045
586,716	821,918
586,887	821,801
587,027	821,654
587,128	821,456
587,319	821,405
587,256	821,682

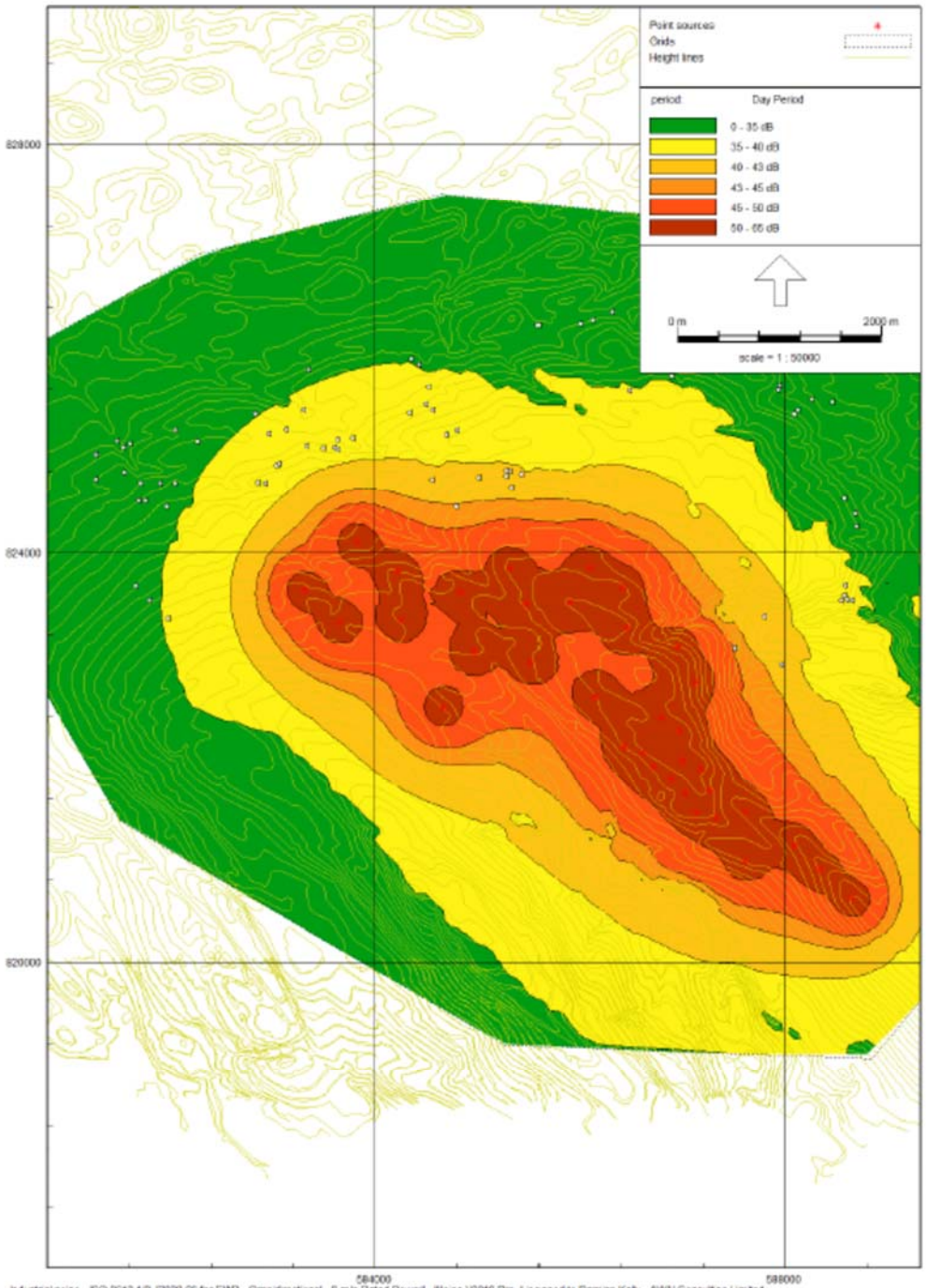

Point sources
Grids
Height lines
period
Day Period
0 - 35 dB
35 - 40 dB
40 - 43 dB
43 - 45 dB
45 - 50 dB
50 - 65 dB
0 m
2000 m
scale = 1 : 50000
828000
824000
820000
584000
588000

Table A11.1 Cumulative Predicted Turbine Noise Levels for the North sector (0°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	26.2	29.6	31.1	31.9	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	25.2	28.6	30.1	31	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	21.4	24.6	26.1	27	27.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	22.3	25.6	27.1	28	28.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	23.4	26.7	28.2	29	29.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	23.1	26.3	27.9	28.8	29.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	23	26.3	27.8	28.7	29.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	24.4	27.8	29.3	30.1	30.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	18.9	22.3	23.8	24.6	24.9

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	19	22.4	23.8	24.7	25.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	19.6	23.1	24.5	25.4	25.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	21.6	24.8	26.3	27.2	27.8
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	22.7	26	27.5	28.4	28.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	26.6	30.1	31.6	32.4	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	27.1	30.5	32.1	32.9	33.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	23.2	26.4	28	28.9	29.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	24.4	27.7	29.3	30.1	30.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	26	29.6	31.1	31.9	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	24.5	27.8	29.4	30.2	30.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	25.6	29	30.5	31.4	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	25.9	29.2	30.8	31.6	31.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	25.9	29.2	30.8	31.7	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	26.3	29.7	31.3	32.1	32.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	25.9	29.4	30.9	31.7	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	22.1	24.9	26.7	27.7	28.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	22.2	24.9	26.8	27.8	28.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	23.2	25.9	27.8	28.8	29.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	23.6	26.9	28.5	29.4	29.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	23.6	26.7	28.4	29.3	29.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	24.5	27.5	29.4	30.3	31.1
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	26.2	28.9	30.8	31.8	32.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	28.6	31	33.2	34.2	35.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	27.6	29.6	32	33.1	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	29	30.8	33.4	34.5	35.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	27.4	29.3	31.8	32.9	34.1
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	29.3	32.4	34.1	35	35.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	31.2	34	36	36.9	37.5
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	28.2	30.2	32.7	33.8	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	19.5	22.1	24	25	26.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	19	21.3	23.3	24.5	25.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	18.9	21.2	23.3	24.4	25.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	18	19.5	22	23.4	25.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	17.9	19.6	22	23.3	25.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	18	19.6	22.1	23.4	25.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	19.5	21.1	23.5	24.8	26.7
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	19.6	21.2	23.7	24.9	26.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	19.4	20.9	23.5	24.9	26.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	20	21.5	24.1	25.5	27.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	18.9	19.9	22.8	24.3	26.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	19.1	20.4	23.1	24.6	26.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	19.5	20.8	23.5	25.1	27.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	19.4	20.7	23.4	25	26.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	18.6	19.6	22.3	23.9	25.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	18.3	19.4	22.2	23.7	25.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	20.5	21.3	24.3	26	28.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	20.7	21.5	24.6	26.3	28.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	21.2	21.9	25.1	26.7	28.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	25.3	25.8	29.3	31.3	33.0
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	26.4	27	30.4	32.3	34.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	26	26.6	30	32	33.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	26.3	26.9	30.3	32.3	34.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	26.5	27.1	30.5	32.4	34.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	30.2	30.5	34.2	36.1	37.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	27.8	29.8	32.3	33.4	34.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	34.1	34.3	38.2	40.1	41.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R066	Dwelling	20	23.1	24.7	25.6	26.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	20.8	24	25.6	26.5	27.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	20.6	23.6	25.1	26	26.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	32.2	32.6	36.3	38.3	39.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	22.2	23.8	26.3	27.6	29.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	18.6	20	22.6	24.1	26.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	18.2	20	22.3	23.6	25.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	23.7	26.9	28.5	29.4	29.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	23.5	26.9	28.4	29.3	29.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	26.1	29.5	31.1	31.9	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	26.7	30	31.6	32.4	32.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	25.9	28.6	30.5	31.5	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	27.6	31	32.5	33.4	33.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.1 Cumulative Predicted Turbine Noise Levels for the Northeast sector (45°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	28.2	31.6	33.1	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	27.3	30.7	32.2	33.1	33.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	25.2	28.4	29.9	30.8	31.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	26	29.3	30.8	31.7	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	26.8	30.1	31.6	32.4	32.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	26.5	29.7	31.3	32.2	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	26.7	30	31.5	32.4	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	27.7	31.1	32.6	33.4	33.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	23	26.4	27.9	28.7	29.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	22.8	26.2	27.6	28.5	29.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	23.6	27.1	28.5	29.4	29.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	25.5	28.7	30.2	31.1	31.7
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	26.6	29.9	31.4	32.3	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	30	33.5	35	35.8	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	30.4	33.8	35.4	36.2	36.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	26.5	29.7	31.3	32.2	32.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	27.7	31	32.6	33.4	33.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	29.1	32.7	34.2	35	35.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	27.7	31	32.6	33.4	33.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	28.6	32	33.5	34.4	34.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	28.4	31.7	33.3	34.1	34.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	28.4	31.7	33.3	34.2	34.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	28.8	32.2	33.8	34.6	34.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	29	32.5	34	34.8	34.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	24.2	27	28.8	29.8	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	24.2	26.9	28.8	29.8	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	25	27.7	29.6	30.6	31.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	25.3	28.6	30.2	31.1	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	25.2	28.3	30	30.9	31.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	26.2	29.2	31.1	32	32.8
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	27.7	30.4	32.3	33.3	34.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	30	32.4	34.6	35.6	36.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	29.3	31.3	33.7	34.8	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	30.7	32.5	35.1	36.2	37.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	29	30.9	33.4	34.5	35.7
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	30.8	33.9	35.6	36.5	37.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	33.3	36.1	38.1	39	39.6
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	29.8	31.8	34.3	35.4	36.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	20.3	22.9	24.8	25.8	26.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	19.4	21.7	23.7	24.9	26.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	19.6	21.9	24	25.1	26.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	18.8	20.3	22.8	24.2	26.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	18.5	20.2	22.6	23.9	25.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	18.4	20	22.5	23.8	25.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	19.6	21.2	23.6	24.9	26.8
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	19.7	21.3	23.8	25	26.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	19.8	21.3	23.9	25.3	27.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	20.3	21.8	24.4	25.8	27.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	18	19	21.9	23.4	25.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	18.3	19.6	22.3	23.8	25.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	18.6	19.9	22.6	24.2	26.1

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	18.5	19.8	22.5	24.1	26.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	17.9	18.9	21.6	23.2	25.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	17.7	18.8	21.6	23.1	25.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	19.6	20.4	23.4	25.1	27.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	19.3	20.1	23.2	24.9	27.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	19.7	20.4	23.6	25.2	27.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	23.6	24.1	27.6	29.6	31.3
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	24.5	25.1	28.5	30.4	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	24.1	24.7	28.1	30.1	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	24.4	25	28.4	30.4	32.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	24.6	25.2	28.6	30.5	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	28.4	28.7	32.4	34.3	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	29.4	31.4	33.9	35	36.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	31.9	32.1	36	37.9	39.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R066	Dwelling	24.1	27.2	28.8	29.7	30.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	24.6	27.8	29.4	30.3	30.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	23	26	27.5	28.4	28.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	29.6	30	33.7	35.7	37.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	22.6	24.2	26.7	28	29.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	18.1	19.5	22.1	23.6	25.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	19.2	21	23.3	24.6	26.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	26.4	29.6	31.2	32.1	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	27.3	30.7	32.2	33.1	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	28.7	32.1	33.7	34.5	34.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	29.2	32.5	34.1	34.9	35.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	27.5	30.2	32.1	33.1	33.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	29.4	32.8	34.3	35.2	35.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.3 Cumulative Predicted Turbine Noise Levels for the East sector (90°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	28.2	31.6	33.1	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	27.3	30.7	32.2	33.1	33.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	25.8	29	30.5	31.4	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	26.6	29.9	31.4	32.3	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	27.2	30.5	32	32.8	33.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	26.8	30	31.6	32.5	32.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	27.4	30.7	32.2	33.1	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	28.2	31.6	33.1	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	23.8	27.2	28.7	29.5	29.8

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	23.9	27.3	28.7	29.6	30.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	24.5	28	29.4	30.3	30.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	26.7	29.9	31.4	32.3	32.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	27.9	31.2	32.7	33.6	34.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	31.9	35.4	36.9	37.7	37.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	32.5	35.9	37.5	38.3	38.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	28.6	31.8	33.4	34.3	34.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	29.8	33.1	34.7	35.5	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	31.3	34.9	36.4	37.2	37.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	29.9	33.2	34.8	35.6	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	31.2	34.6	36.1	37	37.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	31.3	34.6	36.2	37	37.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	31.2	34.5	36.1	37	37.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	31.8	35.2	36.8	37.6	37.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	31.2	34.7	36.2	37	37.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	27.3	30.1	31.9	32.9	33.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	27.2	29.9	31.8	32.8	33.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	28.1	30.8	32.7	33.7	34.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	28	31.3	32.9	33.8	34.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	28.1	31.2	32.9	33.8	34.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	29.2	32.2	34.1	35	35.8
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	30.6	33.3	35.2	36.2	36.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	33.1	35.5	37.7	38.7	39.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	32	34	36.4	37.5	38.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	33.3	35.1	37.7	38.8	40.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	31.6	33.5	36	37.1	38.3
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	33	36.1	37.8	38.7	39.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	35.2	38	40	40.9	41.5
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	32.4	34.4	36.9	38	39.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	23.6	26.2	28.1	29.1	30.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	22.3	24.6	26.6	27.8	29.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	22.6	24.9	27	28.1	29.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	21.7	23.2	25.7	27.1	29.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	21.3	23	25.4	26.7	28.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	21.1	22.7	25.2	26.5	28.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	22.2	23.8	26.2	27.5	29.4
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	22.3	23.9	26.4	27.6	29.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	22.4	23.9	26.5	27.9	29.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	22.9	24.4	27	28.4	30.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	20.2	21.2	24.1	25.6	27.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	20.5	21.8	24.5	26	27.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	20.5	21.8	24.5	26.1	28.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	20.4	21.7	24.4	26	27.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	20	21	23.7	25.3	27.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	19.8	20.9	23.7	25.2	27.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	21.3	22.1	25.1	26.8	28.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	21.1	21.9	25	26.7	28.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	21.2	21.9	25.1	26.7	28.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	24.8	25.3	28.8	30.8	32.5
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	25.3	25.9	29.3	31.2	33.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	24.9	25.5	28.9	30.9	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	25.2	25.8	29.2	31.2	32.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	25.5	26.1	29.5	31.4	33.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	29.4	29.7	33.4	35.3	36.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	32	34	36.5	37.6	38.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	32.9	33.1	37	38.9	40.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R066	Dwelling	24.6	27.7	29.3	30.2	30.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	24.9	28.1	29.7	30.6	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	26.4	29.4	30.9	31.8	32.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	30	30.4	34.1	36.1	37.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	25.3	26.9	29.4	30.7	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	20.4	21.8	24.4	25.9	27.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	22.2	24	26.3	27.6	29.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	29.4	32.6	34.2	35.1	35.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	28.1	31.5	33	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	31.9	35.3	36.9	37.7	38.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	32.1	35.4	37	37.8	38.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	30.5	33.2	35.1	36.1	36.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	29.4	32.8	34.3	35.2	35.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.1 Cumulative Predicted Turbine Noise Levels for the Southeast sector (135°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	28.2	31.6	33.1	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	27.3	30.7	32.2	33.1	33.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	25.8	29	30.5	31.4	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	26.6	29.9	31.4	32.3	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	27.2	30.5	32	32.8	33.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	26.8	30	31.6	32.5	32.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	27.4	30.7	32.2	33.1	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	28.2	31.6	33.1	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	23.8	27.2	28.7	29.5	29.8

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	23.9	27.3	28.7	29.6	30.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	24.5	28	29.4	30.3	30.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	26.7	29.9	31.4	32.3	32.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	27.9	31.2	32.7	33.6	34.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	31.9	35.4	36.9	37.7	37.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	32.5	35.9	37.5	38.3	38.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	28.8	32	33.6	34.5	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	30	33.3	34.9	35.7	36.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	31.6	35.2	36.7	37.5	37.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	30.2	33.5	35.1	35.9	36.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	31.6	35	36.5	37.4	37.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	32.1	35.4	37	37.8	38.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	32.2	35.5	37.1	38	38.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	32.5	35.9	37.5	38.3	38.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	31.5	35	36.5	37.3	37.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	28.5	31.3	33.1	34.1	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	28.5	31.2	33.1	34.1	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	29.4	32.1	34	35	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	30	33.3	34.9	35.8	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	29.7	32.8	34.5	35.4	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	30.5	33.5	35.4	36.3	37.1
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	31.9	34.6	36.5	37.5	38.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	34	36.4	38.6	39.6	40.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	33.4	35.4	37.8	38.9	40.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	34.7	36.5	39.1	40.2	41.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	33.1	35	37.5	38.6	39.8
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	34.6	37.7	39.4	40.3	40.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	36.2	39	41	41.9	42.5
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	33.9	35.9	38.4	39.5	40.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	25.7	28.3	30.2	31.2	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	25	27.3	29.3	30.5	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	25.1	27.4	29.5	30.6	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	24.4	25.9	28.4	29.8	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	24.1	25.8	28.2	29.5	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	24	25.6	28.1	29.4	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	25.3	26.9	29.3	30.6	32.5
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	25.4	27	29.5	30.7	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	25.3	26.8	29.4	30.8	32.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	25.8	27.3	29.9	31.3	33.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	23.3	24.3	27.2	28.7	30.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	23.7	25	27.7	29.2	31.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	23.9	25.2	27.9	29.5	31.4

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	23.8	25.1	27.8	29.4	31.3
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	23.2	24.2	26.9	28.5	30.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	22.9	24	26.8	28.3	30.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	24.1	24.9	27.9	29.6	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	23.8	24.6	27.7	29.4	31.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	24	24.7	27.9	29.5	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	27.8	28.3	31.8	33.8	35.5
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	28.1	28.7	32.1	34	35.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	27.7	28.3	31.7	33.7	35.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	28	28.6	32	34	35.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	28.3	28.9	32.3	34.2	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	32.1	32.4	36.1	38	39.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	33.4	35.4	37.9	39	40.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	35.7	35.9	39.8	41.7	43.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	0.1
R066	Dwelling	24.6	27.7	29.3	30.2	30.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	24.9	28.1	29.7	30.6	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	27	30	31.5	32.4	32.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	32.4	32.8	36.5	38.5	40.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	28.1	29.7	32.2	33.5	35.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	23.6	25	27.6	29.1	31.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	24.7	26.5	28.8	30.1	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	29.7	32.9	34.5	35.4	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	28.1	31.5	33	33.9	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	32.2	35.6	37.2	38	38.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	32.9	36.2	37.8	38.6	38.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	31.7	34.4	36.3	37.3	38.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	29.4	32.8	34.3	35.2	35.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.1 Cumulative Predicted Turbine Noise Levels for the South sector (180°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	26.1	29.5	31	31.8	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	25.4	28.8	30.3	31.2	31.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	25.5	28.7	30.2	31.1	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	26.2	29.5	31	31.9	32.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	26.6	29.9	31.4	32.2	32.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	26.2	29.4	31	31.9	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	27.1	30.4	31.9	32.8	33.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	27.6	31	32.5	33.3	33.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	23.8	27.2	28.7	29.5	29.8

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	23.8	27.2	28.6	29.5	30.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	24.5	28	29.4	30.3	30.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	26.7	29.9	31.4	32.3	32.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	27.8	31.1	32.6	33.5	34.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	31.9	35.4	36.9	37.7	37.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	32.4	35.8	37.4	38.2	38.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	28.8	32	33.6	34.5	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	30	33.3	34.9	35.7	36.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	31.6	35.2	36.7	37.5	37.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	30.2	33.5	35.1	35.9	36.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	31.6	35	36.5	37.4	37.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	32.1	35.4	37	37.8	38.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	32.2	35.5	37.1	38	38.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	32.5	35.9	37.5	38.3	38.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	31.5	35	36.5	37.3	37.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	28.5	31.3	33.1	34.1	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	28.6	31.3	33.2	34.2	35.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	29.5	32.2	34.1	35.1	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	30	33.3	34.9	35.8	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	29.8	32.9	34.6	35.5	36.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	30.7	33.7	35.6	36.5	37.3
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	32.2	34.9	36.8	37.8	38.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	34.5	36.9	39.1	40.1	41.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	33.8	35.8	38.2	39.3	40.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	35.1	36.9	39.5	40.6	41.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	33.6	35.5	38	39.1	40.3
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	35.1	38.2	39.9	40.8	41.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	36.9	39.7	41.7	42.6	43.2
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	0.2
R038	Dwelling	34.3	36.3	38.8	39.9	41.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	26	28.6	30.5	31.5	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	25.4	27.7	29.7	30.9	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	25.5	27.8	29.9	31	32.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	24.7	26.2	28.7	30.1	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	24.4	26.1	28.5	29.8	31.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	24.5	26.1	28.6	29.9	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	25.8	27.4	29.8	31.1	33.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	25.9	27.5	30	31.2	33.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	25.8	27.3	29.9	31.3	33.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	26.3	27.8	30.4	31.8	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	24.6	25.6	28.5	30	32.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	24.9	26.2	28.9	30.4	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	25.1	26.4	29.1	30.7	32.6

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	25.1	26.4	29.1	30.7	32.6
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	24.4	25.4	28.1	29.7	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	24.1	25.2	28	29.5	31.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	25.7	26.5	29.5	31.2	33.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	25.5	26.3	29.4	31.1	33.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	25.9	26.6	29.8	31.4	33.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	29.7	30.2	33.7	35.7	37.4
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	30.2	30.8	34.2	36.1	37.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	29.8	30.4	33.8	35.8	37.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	30.1	30.7	34.1	36.1	37.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	30.3	30.9	34.3	36.2	37.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	34	34.3	38	39.9	41.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	33.9	35.9	38.4	39.5	40.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	37.4	37.6	41.5	43.4	44.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	1.5	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	0.4	1.8
R066	Dwelling	24.4	27.5	29.1	30	30.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	24.4	27.6	29.2	30.1	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	27	30	31.5	32.4	32.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	34.3	34.7	38.4	40.4	41.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	28.6	30.2	32.7	34	35.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	24.6	26	28.6	30.1	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	24.9	26.7	29	30.3	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	29.7	32.9	34.5	35.4	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	27.8	31.2	32.7	33.6	34.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	32.2	35.6	37.2	38	38.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	32.9	36.2	37.8	38.6	38.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	32	34.7	36.6	37.6	38.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	27.1	30.5	32	32.9	33.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.1 Cumulative Predicted Turbine Noise Levels for the Southwest sector (225°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	22.8	26.2	27.7	28.5	28.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	22.1	25.5	27	27.9	28.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	22	25.2	26.7	27.6	28.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	22.8	26.1	27.6	28.5	29.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	22.9	26.2	27.7	28.5	29.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	22.4	25.6	27.2	28.1	28.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	23.9	27.2	28.7	29.6	30.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	24.3	27.7	29.2	30	30.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	20.5	23.9	25.4	26.2	26.5

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	20.9	24.3	25.7	26.6	27.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	21.2	24.7	26.1	27	27.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	23.8	27	28.5	29.4	30.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	25.1	28.4	29.9	30.8	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	29.9	33.4	34.9	35.7	35.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	30.6	34	35.6	36.4	36.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	27.1	30.3	31.9	32.8	33.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	28.3	31.6	33.2	34	34.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	30.1	33.7	35.2	36	36.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	28.8	32.1	33.7	34.5	34.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	30.5	33.9	35.4	36.3	36.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	31.5	34.8	36.4	37.2	37.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	31.6	34.9	36.5	37.4	37.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	31.9	35.3	36.9	37.7	38.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	30.1	33.6	35.1	35.9	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	28	30.8	32.6	33.6	34.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	28.2	30.9	32.8	33.8	34.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	29.1	31.8	33.7	34.7	35.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	29.7	33	34.6	35.5	35.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	29.4	32.5	34.2	35.1	35.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	30.3	33.3	35.2	36.1	36.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	31.8	34.5	36.4	37.4	38.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	34.1	36.5	38.7	39.7	40.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	33.4	35.4	37.8	38.9	40.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	34.7	36.5	39.1	40.2	41.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	33.2	35.1	37.6	38.7	39.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	34.5	37.6	39.3	40.2	40.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	36.1	38.9	40.9	41.8	42.4
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	33.9	35.9	38.4	39.5	40.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	26	28.6	30.5	31.5	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	25.4	27.7	29.7	30.9	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	25.5	27.8	29.9	31	32.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	24.7	26.2	28.7	30.1	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	24.4	26.1	28.5	29.8	31.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	24.5	26.1	28.6	29.9	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	25.8	27.4	29.8	31.1	33.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	25.9	27.5	30	31.2	33.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	25.8	27.3	29.9	31.3	33.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	26.3	27.8	30.4	31.8	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	24.6	25.6	28.5	30	32.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	24.9	26.2	28.9	30.4	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	25.2	26.5	29.2	30.8	32.7

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	25.1	26.4	29.1	30.7	32.6
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	24.4	25.4	28.1	29.7	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	24.1	25.2	28	29.5	31.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	25.9	26.7	29.7	31.4	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	25.8	26.6	29.7	31.4	33.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	26.2	26.9	30.1	31.7	33.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	30	30.5	34	36	37.7
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	30.7	31.3	34.7	36.6	38.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	30.3	30.9	34.3	36.3	38.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	30.6	31.2	34.6	36.6	38.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	30.8	31.4	34.8	36.7	38.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	34.5	34.8	38.5	40.4	42.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	33.5	35.5	38	39.1	40.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	38	38.2	42.1	44	45.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	2.1	--	0.4
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	1	2.4
R066	Dwelling	20.8	23.9	25.5	26.4	27.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	20.4	23.6	25.2	26.1	26.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	26.5	29.5	31	31.9	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	35.4	35.8	39.5	41.5	43.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	28.6	30.2	32.7	34	35.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	24.6	26	28.6	30.1	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	24.9	26.7	29	30.3	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	28.8	32	33.6	34.5	35.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	24.6	28	29.5	30.4	30.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	31.5	34.9	36.5	37.3	37.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	32.3	35.6	37.2	38	38.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	31.6	34.3	36.2	37.2	38.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	23.8	27.2	28.7	29.6	29.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.1 Cumulative Predicted Turbine Noise Levels for the West sector (270°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	21	24.4	25.9	26.7	27.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	20.1	23.5	25	25.9	26.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	19.5	22.7	24.2	25.1	25.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	20.3	23.6	25.1	26	26.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	20.8	24.1	25.6	26.4	26.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	20.4	23.6	25.2	26.1	26.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	21.3	24.6	26.1	27	27.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	21.9	25.3	26.8	27.6	28.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	17.9	21.3	22.8	23.6	23.9

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	18	21.4	22.8	23.7	24.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	18.6	22.1	23.5	24.4	24.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	21	24.2	25.7	26.6	27.2
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	22.2	25.5	27	27.9	28.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	26.3	29.8	31.3	32.1	32.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	26.9	30.3	31.9	32.7	32.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	23.7	26.9	28.5	29.4	29.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	25.1	28.4	30	30.8	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	26.8	30.4	31.9	32.7	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	25.8	29.1	30.7	31.5	31.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	27.3	30.7	32.2	33.1	33.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	28.7	32	33.6	34.4	34.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	29.1	32.4	34	34.9	35.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	28.8	32.2	33.8	34.6	34.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	26.9	30.4	31.9	32.7	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	25.7	28.5	30.3	31.3	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	26.1	28.8	30.7	31.7	32.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	27.1	29.8	31.7	32.7	33.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	28.3	31.6	33.2	34.1	34.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	27.8	30.9	32.6	33.5	34.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	28.4	31.4	33.3	34.2	35.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	30.1	32.8	34.7	35.7	36.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	32	34.4	36.6	37.6	38.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	31.9	33.9	36.3	37.4	38.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	33.1	34.9	37.5	38.6	39.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	31.7	33.6	36.1	37.2	38.4
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	33.3	36.4	38.1	39	39.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	34.8	37.6	39.6	40.5	41.1
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	32.3	34.3	36.8	37.9	39.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	24.6	27.2	29.1	30.1	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	24.4	26.7	28.7	29.9	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	24.3	26.6	28.7	29.8	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	23.4	24.9	27.4	28.8	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	23.4	25.1	27.5	28.8	30.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	23.6	25.2	27.7	29	30.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	25.1	26.7	29.1	30.4	32.3
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	25.2	26.8	29.3	30.5	32.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	25	26.5	29.1	30.5	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	25.5	27	29.6	31	32.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	24.3	25.3	28.2	29.7	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	24.6	25.9	28.6	30.1	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	24.9	26.2	28.9	30.5	32.4

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	24.8	26.1	28.8	30.4	32.3
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	24	25	27.7	29.3	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	23.7	24.8	27.6	29.1	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	25.5	26.3	29.3	31	33.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	25.4	26.2	29.3	31	33.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	25.9	26.6	29.8	31.4	33.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	29.8	30.3	33.8	35.8	37.5
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	30.5	31.1	34.5	36.4	38.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	30.1	30.7	34.1	36.1	37.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	30.4	31	34.4	36.4	38.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	30.6	31.2	34.6	36.5	38.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	34.3	34.6	38.3	40.2	41.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	31.9	33.9	36.4	37.5	38.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	37.8	38	41.9	43.8	45.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	1.9	--	0.2
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	0.8	2.2
R066	Dwelling	18.4	21.5	23.1	24	24.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	18.5	21.7	23.3	24.2	24.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	23.1	26.1	27.6	28.5	28.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	35.2	35.6	39.3	41.3	42.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	27.7	29.3	31.8	33.1	34.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	24.1	25.5	28.1	29.6	31.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	23.6	25.4	27.7	29	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	25.3	28.5	30.1	31	31.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	22	25.4	26.9	27.8	28.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	27.9	31.3	32.9	33.7	34.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	29.4	32.7	34.3	35.1	35.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	29.8	32.5	34.4	35.4	36.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	22.3	25.7	27.2	28.1	28.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

Table A11.1 Cumulative Predicted Turbine Noise Levels for the Northwest (315°)

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R001	Dwelling	22.9	26.3	27.8	28.6	29.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R002	Dwelling	21.9	25.3	26.8	27.7	28.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R003	Dwelling	19.4	22.6	24.1	25	25.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R004	Dwelling	20.2	23.5	25	25.9	26.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R005	Dwelling	20.9	24.2	25.7	26.5	27.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R006	Dwelling	20.6	23.8	25.4	26.3	26.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R007	Dwelling	20.9	24.2	25.7	26.6	27.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R008	Dwelling	21.9	25.3	26.8	27.6	28.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R009	Dwelling	17.1	20.5	22	22.8	23.1

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R010	Dwelling	17.1	20.5	21.9	22.8	23.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R011	Dwelling	17.8	21.3	22.7	23.6	23.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R012	Dwelling	19.8	23	24.5	25.4	26.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R013	Dwelling	21	24.3	25.8	26.7	27.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R014	Dwelling	25.3	28.8	30.3	31.1	31.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R015	Dwelling	25.8	29.2	30.8	31.6	31.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R016	Dwelling	21.9	25.1	26.7	27.6	28.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R017	Dwelling	23.2	26.5	28.1	28.9	29.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R018	Dwelling	24.8	28.4	29.9	30.7	30.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R019	Dwelling	23.6	26.9	28.5	29.3	29.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R020	Dwelling	25.1	28.5	30	30.9	31.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R021	Dwelling	26	29.3	30.9	31.7	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R022	Dwelling	26.3	29.6	31.2	32.1	32.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R023	Dwelling	26.4	29.8	31.4	32.2	32.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R024	Dwelling	24.7	28.2	29.7	30.5	30.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R025	Dwelling	22.6	25.4	27.2	28.2	29.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R026	Dwelling	22.7	25.4	27.3	28.3	29.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R027	Dwelling	23.8	26.5	28.4	29.4	30.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R028	Dwelling	24.7	28	29.6	30.5	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R029	Dwelling	24.4	27.5	29.2	30.1	30.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R030	Dwelling	25.4	28.4	30.3	31.2	32.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R031	Dwelling	27.3	30	31.9	32.9	33.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R032	Dwelling	30.1	32.5	34.7	35.7	36.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R033	Derelict	29.3	31.3	33.7	34.8	36.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R034	Dwelling	30.5	32.3	34.9	36	37.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R035	Dwelling	29.3	31.2	33.7	34.8	36.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R036	Dwelling	30.5	33.6	35.3	36.2	36.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R037	Dwelling	32.8	35.6	37.6	38.5	39.1
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R038	Dwelling	29.7	31.7	34.2	35.3	36.5
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R039	Dwelling	21.6	24.2	26.1	27.1	28.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R040	Dwelling	21.2	23.5	25.5	26.7	28.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R041	Dwelling	21.1	23.4	25.5	26.6	28.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R042	Dwelling	20.1	21.6	24.1	25.5	27.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Excess	--	--	--	--	--
R043	Dwelling	20.1	21.8	24.2	25.5	27.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R044	Dwelling	20.3	21.9	24.4	25.7	27.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R045	Dwelling	21.8	23.4	25.8	27.1	29.0
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R046	Derelict	22	23.6	26.1	27.3	29.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R047	Dwelling	21.8	23.3	25.9	27.3	29.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R048	Derelict	22.4	23.9	26.5	27.9	29.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R049	Dwelling	21.9	22.9	25.8	27.3	29.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R050	Dwelling	22	23.3	26	27.5	29.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R051	Derelict	22.5	23.8	26.5	28.1	30.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R052	Dwelling	22.4	23.7	26.4	28	29.9
	Daytime Criterion	40.0	40.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R053	Dwelling	21.5	22.5	25.2	26.8	28.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R054	Dwelling	21.3	22.4	25.2	26.7	28.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R055	Dwelling	23.8	24.6	27.6	29.3	31.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R056	Derelict	23.9	24.7	27.8	29.5	31.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R057	Dwelling	24.5	25.2	28.4	30	32.2
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R058	Dwelling	28.4	28.9	32.4	34.4	36.1
	Daytime Criterion	40.0	45.0	45.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R059	Dwelling	29.3	29.9	33.3	35.2	37.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R060	Derelict	29	29.6	33	35	36.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R061	Dwelling	29.2	29.8	33.2	35.2	36.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R062	Derelict	29.4	30	33.4	35.3	37.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R063	Derelict	33.1	33.4	37.1	39	40.6
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R064	Dwelling	29.3	31.3	33.8	34.9	36.1
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R065	Dwelling	36.4	36.6	40.5	42.4	43.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	0.5	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	0.8
R066	Dwelling	18.2	21.3	22.9	23.8	24.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R067	Dwelling	18.6	21.8	23.4	24.3	24.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
R068	Derelict	20.7	23.7	25.2	26.1	26.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R069	Dwelling	34.3	34.7	38.4	40.4	41.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R070	Dwelling	24.7	26.3	28.8	30.1	31.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R071	Derelict	21.5	22.9	25.5	27	28.9
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R072	Dwelling	20.3	22.1	24.4	25.7	27.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R073	Dwelling	23.2	26.4	28	28.9	29.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R074	Dwelling	21.5	24.9	26.4	27.3	27.7
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R075	Dwelling	25.9	29.3	30.9	31.7	32.0
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R076	Dwelling	26.8	30.1	31.7	32.5	32.8
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0

House ID	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)				
		4	5	6	7	≥8
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R077	Derelict	27	29.7	31.6	32.6	33.4
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--
R078	Derelict	24.2	27.6	29.1	30	30.3
	Daytime Criterion	40.0	40.0	40.0	45.0	45.0
	Daytime Excess	--	--	--	--	--
	Night time Criterion	43.0	43.0	43.0	43.0	43.0
	Night time Excess	--	--	--	--	--

1. LVIA METHODOLOGY

1.1 Scope and Definition of Landscape and Visual Impact (LVIA) Study Area

For the purposes of this EIAR, where the 'proposed development site' or 'the site' is referred to, this relates to the primary study area for the proposed development, as delineated in green on the EIAR figures (maps).

However, the landscape and visual baseline mapping and viewpoint selection are based on wider study areas. The landscape study area has been chosen as 20 kilometres for visual and landscape effects and 15 kilometres from the proposed wind turbines for effects on landscape character. These are the study areas for which the baseline maps and viewpoint locations are produced and are referred to as the 'study area'. Furthermore, on the basis of desk studies and survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards, the following topic areas have been scoped out of the assessment:

- Effects on landscape and visual receptors that have minimal or no theoretical visibility (as predicted by the ZTV) and/or very distant visibility, and are therefore unlikely to be subject to significant effects;
- Effects on designated landscapes beyond a 20km radius from the proposed development, from where it is judged that potential significant effects on key characteristics and/or special qualities, or views are judged unlikely to occur;
- Effects on landscape character beyond a 15km radius from the proposed development, where it is judged that potential significant effects on landscape character are unlikely to occur;
- Effects on visual receptors beyond a 20km radius from the proposed development, where it is judged that potential significant effects are unlikely to occur;
- Cumulative effects in relation to single turbines (except where otherwise stated);
- Cumulative landscape effects beyond a 15km radius and cumulative visual effects beyond a 20km radius from the proposed development, where it is judged that potential significant effects on landscape character are unlikely to occur;
- Visual effects during the construction phase and cumulative landscape and visual effects during the construction phase;
- All potential effects occurring during decommissioning of the Proposed Development.
- Areas in County Cavan due to distance from the proposed development and the lack of significant visual or landscape receptors falling into the small area of the county falling within the study area

1.2 Zone of Theoretical Visibility Mapping

The Zone of Theoretical Visibility (ZTV) represents the area over which a development can theoretically be seen and is based on a Digital Terrain Model (DTM), overlaid on a map base. A DTM refers to the way in which a computer represents a piece of topography in three dimensions as a digital model. ZTV maps provide the following information:

- Indicates broad areas where visibility of a wind energy development is most likely to occur;
- How much of the wind energy development is likely to be visible (using different coloured bands for different numbers of turbines);
- The extent and pattern of visibility.

Production of ZTV maps is usually one of the first steps of Visual Impact Assessment, helping to inform the selection of the Study Area in which impacts will be considered in more detail and the identification of sensitive vantage points. (Visual Representation of Wind Farms, Scottish Natural Heritage, 2017).

1.2.1 Limitations of ZTV Mapping

The Scottish Natural Heritage guidelines referred to above acknowledge the following limitations inherent to the use of theoretical visibility mapping:

- The ZTV presents a 'bare ground' scenario, i.e. visibility of the proposed development in a landscape without screening structures or vegetation. This includes trees, hedgerows, buildings and small-scale landform or ground surface features. The ZTV also does not take into account the effects of weather and atmospheric conditions, and therefore can be said to represent a 'worst-case' scenario, that is where the wind farm could potentially be seen given no intervening obstructions and favourable weather conditions.
- The ZTV indicates areas from where a wind farm may be visible, but cannot show how it will look, nor indicate the nature or magnitude of visual impacts. The visibility of the turbines will decrease with the distance from which they are viewed, but this is not accounted for in the ZTV. Figure 11.1 below provides an illustration of the differences in view relative to the distance from a turbine.



Figure 1-1 The effect of distance on visibility of wind turbines (Illustrative Purposes Only)

- A ZTV is only as accurate as the data on which it is based. It is not easy to test the accuracy of a ZTV in the field, although some verification will occur during the assessment of viewpoints.
- In order to handle large areas of terrain, the DTM data is based on information that does not allow detail to be distinguished below a certain level. There are also differences in the way that the software package 'interpolates' between heights in the calculations made.

1.2.2 ZTV Methodology

The ZTV maps presented in the EIAR show visibility of the proposed wind farm using the half blade height of the wind turbines as points of reference. Separate colour bands are used on each ZTV map to indicate the number of turbines which will potentially be visible to half blade i.e. only half a blade might be visible over the topography as opposed to seeing a full turbine. The legend on each map shows the number of visible turbines for each corresponding colour. Hub Height ZTS, are also conventionally used, including only areas where the turbines will be seen above hub height. However, as the half-blade ZTV represents a worst-case scenario this model is used in the assessment rather than the hub height ZTV.

The maps also show the visibility of the proposed wind farm in addition to visibility of other existing and permitted wind farms in the area. The area covered by the ZTV maps has a radius of 20 kilometres from the outer-most proposed turbines. As this ZTV area includes a considerable proportion of sea, the ZTV maps show only the visibility on land.

ZTV maps assume a worst-case or 'bare ground' scenario, i.e. no land-cover. They represent visibility of the proposed wind farm in the absence of all natural and manmade features from the landscape, including vegetation, houses and other buildings. In reality, such features will restrict or limit visibility of the wind turbines, due to the screening effects of vegetation, for example forestry and road-side hedgerows and trees, and buildings, particularly within towns and villages.

1.2.3 Route Screening Methodology - Roads

In order to comprehensively demonstrate the varying roadside screening and to record the actual visibility in comparison to the theoretical visibility, a methodology was developed. This is termed Route Screening Analysis and it was undertaken from all roads within a five-kilometre radius of the proposed turbines that have theoretical visibility indicated by the ZTV map. Roads beyond five kilometres from the turbines were not surveyed, as with increasing distance any screening by individual landscape elements such as trees or buildings decreases in significance.

Route Screening Analysis as its name suggests considers the actual visibility of the proposed wind farm from surrounding roads. Within 5km of the proposed development, the area generally comprises upland forested areas, agricultural land, a network of trees and hedgerows, and settlements. In order to get a clearer understanding of visibility and screening, and to bridge the gap for the assessor between the computer-generated ZTV maps and the actual nature of visibility in the study area, Route Screening Analysis was undertaken.

Within a five-kilometre radius of the proposed development site boundary, each route with theoretical visibility was driven, with notes taken on screening, views, and the direction of the views to the proposed development.

In preparation for the route screening assessment, the ZTV maps were overlaid with aerial imagery and printed at a large scale. Each route was driven once in each direction as a minimum. The route was driven slowly along the route and mapping and notes of each section of roadway on a high-resolution aerial image was carried out. Screening between the wind farm site and the relevant side of the road was marked. In cases where the road travels directly in the direction of the proposed wind farm, screening on both sides of the road was included and the most representative of the two roadsides were mapped.

In addition, photographs were taken at regular intervals of approximately 500 metres along the routes to allow later confirmation of mapping, and to methodically record the views along the route. A photograph of the view along the road was taken in each direction, as well as the view to either side of the road. Following the site visit, a map was created of each route. The screening along the route was mapped as one of three categories:

The categories were as follows:

- Little/no screening – mainly open and with some very light vegetation
- Intermittent/Partial Screening – light deciduous roadside vegetation and vegetation with short gaps which would allow intermittent or partial views
- Dense Screening – vegetation which is dense enough to block views (e.g. coniferous forestry)

1.3 Viewpoint Photomontages

1.3.1 Viewpoint Identification

The viewpoints or photo locations were selected following guidance contained in the DoEHLG *'Wind Energy Development Guidelines for Planning Authorities'* (2006), the *'Guidelines for Landscape and*

Visual Impact Assessment' (2013) and in the *'Visual Representation of Wind Farms'* (Scottish Natural Heritage, 2017). The selection of photo locations is designed to give a representative range of views of the proposed development.

Viewpoints, the photo locations from which the photomontages are produced, were chosen after compiling the Visual Baseline. The main purpose of establishing the visual baseline is to identify the key visual receptors that should be considered for viewpoint selection. To this end the following have been identified in order of priority:

- Designated Scenic Routes and Scenic Views
- Settlements
- Recreational and Tourist Destinations
- Recreational Routes
    - Waymarked Walking Routes
    - Cycle Routes
    - Scenic Drives
    - Tourist Routes (e.g. Wild Atlantic Way)
- Viewing Points (e.g. marked on OS Maps)
- Transport Routes

These visual receptors are listed in tables under the sections identified above along with theoretical visibility at those locations indicated by the ZTV maps.

After all key visual receptors are identified, a Visual Receptor Preliminary Assessment is carried out to eliminate the visual receptors for the following reasons:

- No or very limited theoretical visibility indicated on the ZTV map for the visual receptor
- Designated views and scenic routes as well as OSi Viewing Points that are nor directed towards the proposed development
- Visual receptors visited on site, where views towards the turbines were either entirely screened or substantially screened and distance from the proposed development site would mitigate any visual effects

Establishing visibility on the ground was assisted by the TrueViewVisuals software, which is an iPad-based tool to help visualisation of a project live on the ground before it is built.

All other key visual receptors were selected as viewpoint locations. In addition, viewpoints were selected in close proximity to the proposed turbines, where turbines are likely to be most visible and hence visual effects may be greatest.

Viewpoints were chosen having regard to the SNH Guidance (2017) which advises that a range of views should be shown at a range of distances and aspects, as well as at varying elevations and showing both where the development will be completely visible as well as partially visible. Consideration was also given to ensure that photomontages captured other wind farms in order to assess cumulative visual effects.

1.3.2 Photomontages

Photomontages are visualisations that superimpose an image of a proposed development upon a photograph or series of photographs. They are intended as graphical representations of how a proposed development will appear in the existing landscape and are used as a tool in the LVIA process. A series of photomontages has been prepared as part of this assessment and are presented in a separate Volume 2 Photomontage Booklet to be submitted to along with this EIAR.

1.3.2.1 Photomontage Limitations

Photographs, and therefore photomontages, are subject to a range of limitations, as stated in *'Visual Assessment of Wind Farms'* (Scottish Natural Heritage, 2014):

- Visualisations provide a tool for assessment that can be compared with an actual view in the field; they should never be considered as a substitute to visiting a viewpoint in the field.
- Neither photographs nor visualisations can replicate a view as seen in reality by the human eye.
- Visualisations are only as accurate as the data used to construct them.
- Visualisations can only represent the view from a single location at a particular time and in particular weather conditions.
- Static visualisations cannot convey the effect of turbine blade movement.

Although the scale, siting and geometry of photomontages are based on technical data, the other qualities of the image are open to judgments. The guidance also notes that interpretation of visualisations also needs to take into account additional information including variable lighting, movement of turbine blades, seasonal differences and the movement of the viewer through the landscape. However, accepting these limitations, the SNH guidelines state that photomontages are useful tools in the Visual Impact Assessment of wind turbines.

Furthermore, with regard to the representation of cumulative visual effects, existing and permitted turbines are also shown in the photomontages. The representation of existing turbines relies on photographs taken on site, while permitted and proposed turbines are images of turbines superimposed into the image. As such there can be a discrepancy in the lighting and sharpness between these two different representations.

Photomontages are 2D representations of 3D views and thus cannot convey the perspective and depth pf view of seeing the actual objects with the naked eye. One of the areas that this limitation affects cumulative visual effects is where proposed turbines are proposed to be located in front or behind existing or permitted turbines. In the field this physical separation may be obvious, while on the photomontage the turbines may appear as one wind farm.

1.3.2.2 Photomontage Presentations

The viewpoints presented in the accompanying Photomontage Booklet show several views from each viewpoint location. These include:

1. **Overview Sheet** – Viewpoint details include location description, grid reference distance from nearest turbine and technical data in relation to photography. Three maps at varies scales show the viewpoint location. A 120 -degree existing view image without any proposed and permitted turbine. Existing turbines visible in the landscape may appear within the image and the horizontal extent of the 90-degree and 53.5-degree image to be presented in subsequent images is also framed.
2. **Visual Baseline** - 90-degree existing view image without any proposed or permitted turbines and a matching wireframe image of the same view which includes any existing turbines visible in the landscape. If turbines are already existing in the landscape, these are visible on the photograph and are rendered in the wireframe.
3. **Proposed View (90 degrees)** – Showing a 90-degree photomontage image with the proposed wind farm and all other existing and permitted wind farms within the viewpoint. A matching wireframe image shows the turbines of all proposed, permitted and existing wind farms individually coloured and labelled for ease of identification.

4. **Proposed View (53.5 degrees)** – Showing a photomontage image of the proposed turbines and any existing and permitted turbines in a 53.5-degree horizontal field of view.
5. **Proposed Wireframe (53.5 degrees)** - Showing a wireframe image of the proposed turbines and any existing and permitted turbines in a 53.5-degree horizontal field of view. The proposed turbines and any other existing wind farms are individually coloured and labelled for ease of identification.

The viewpoint images contained in the booklet are devised to be viewed at arms length.

1.4 Landscape and Visual Impact Assessment Methodology

1.4.1 Identification of Landscape Receptors

The landscape receptors were selected following guidance contained the *'Guidelines for Landscape and Visual Impact Assessment'* (2013) and in the *'Visual Representation of Wind Farms'* (Scottish Natural Heritage, 2017).

The following landscape receptors are identified in the landscape baseline:

- **Landscape Designations** based on:
  - County Leitrim
  - County Sligo
  - County Roscommon
- **Landscape Character of the Proposed Development Site** and its immediate environment based on:
  - Landscape Type identified using DoEHLG Guidelines 2006
  - Site Visits
- **Landscape Character of the Study Area** based on:
  - Landscape Assessment of County Leitrim
  - Landscape Character Assessment of County Roscommon
  - Provisional Landscape Character Assessment of County Sligo areas within the LVIA study area (prepared by MKO)

After all landscape receptors are identified, a Landscape Receptor Preliminary Assessment is carried out to eliminate the landscape receptors, where no or very limited theoretical visibility has been indicated on the ZTV map.

All other landscape receptors were selected for further assessment of landscape effects.

1.4.2 Assessing Landscape Effects

The methodology uses qualitative methods in order to arrive at an assessment, which is based on the Landscape and Landscape Assessment (2000) Guidelines as well as the GLVIA (2013), and the DoEHLG (2006) Guidelines were also taken into account.

Landscape effects can be described as changes which affect the landscape as a resource. This includes how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects and its landscape character. Landscape effects also relate to changes in the structure of the landscape. Under the GLVIA (2013), the assessment of likely significant effects on landscape receptors includes a judgement on both the sensitivity of the receptor as well as magnitude of the change.

1.4.2.1 Assessing Landscape Sensitivity

Landscape Sensitivity, which is described in the GLVIA (2013) as a combination of the landscape's susceptibility to change as well as the value attached to the landscape

Susceptibility to change can be described as the ability of the landscape receptor (either the overall character, quality of the landscape or a particular landscape feature) to accommodate the proposed development without undue consequences for the maintenance of the baseline (existing) landscape and/or the aims of landscape planning policies and strategies. Landscape value is a combination of values which are assessed in the landscape baseline, combining any formal landscape designations.

For the purposes of this LVIA and the assessment of landscape sensitivity, the following landscape sensitivity ratings assigned to the landscape character areas were assessed/chosen/identified based on the *Landscape Character Assessment of County Roscommon*, *Landscape Assessment of County Leitrim* and the provisional landscape character assessment carried out by MKO for the Sligo landscape falling within the study area:

- Very High
- High
- Moderate
- Low

1.4.2.2 Assessing Magnitude of Change in the Landscape

The magnitude of change in each landscape character area is a combination of the visual presence - size and scale - of the change, the extent of the area to be affected, and the duration and reversibility of the effect. The magnitude of change for each landscape character area was assessed using the definitions outlined in Table 1-1 below.

Table 1-1 Magnitude of Landscape Change Assessment Criteria

Magnitude of Change	Description
Substantial	Where a landscape will experience the loss of key landscape features or the introduction of uncharacteristic additions over a large area. The changes to the landscape are prominent and large in scale. The level of change has an effect on the overall landscape character.
Moderate	A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not affect key characteristics.
Slight	The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area.

Magnitude of Change	Description
Negligible	A change affecting smaller areas of landscape character including the loss of some landscape elements or the addition of features or elements which are either of low value or hardly noticeable.

1.4.2.3 Landscape Effects Assessment Matrix

The significance of landscape effect was arrived at by combining the magnitude and sensitivity classifications, using the assessment matrix in Table 1-2 below, where landscape sensitivity is shown in the left-hand first column and magnitude of change is shown in the first row at the top of the table.

Table 1-2 Landscape effects significance assessment matrix

	Substantial	Moderate	Slight	Negligible
Very High	Major	Major/Moderate	Moderate	Moderate/Minor
High	Major/Moderate	Moderate	Moderate/Minor	Minor
Moderate	Moderate	Moderate/Minor	Minor	Minor/Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible

The determination of significance uses a seven-point scale, ranging from Major to Negligible. This seven-point scale is translated to the EPA impact assessment classifications of significance, as outlined in Table 1-3 below.

Table 1-3 EPA Impact Assessment Significance Classification for Landscape Effects

Matrix Classification Significance	EPA Significance Classification	EPA (2017) Definition of Significance
Major	Profound	An effect which obliterates sensitive characteristics
Major/Moderate	Very significant	An effect, which by its character, magnitude, duration or intensity alters most of a sensitive aspect of the environment
Moderate	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate/Minor	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Minor	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

Matrix Classification Significance	EPA Significance Classification	EPA (2017) Definition of Significance
Minor/Negligible	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Negligible	Imperceptible	An effect capable of measurement but without significant consequences

1.4.3 Assessing Visual Effects

Visual effects relate to changes in views and visual amenity of the surroundings of individuals or groups of people. These may result from changes in content and character of views as a result in changes to the landscape. The assessment of visual effects is based on views shown in photomontages and the potential visibility indicated by the ZTV maps as well as actual visibility on the ground.

It should be noted that in assessing visual effects, there are different types of visual effects:

- **Visual obstruction:** This occurs when there is an impact on a view which blocks the view
- **Visual intrusion:** This occurs when there is an impact on a view but which does not block the view.

Due to the nature of the development and the appearance of wind turbines, visual intrusion occurs more frequently than obstruction.

The likely significance effects of the proposed development in terms of visual and landscape effects are informed by the ZTV and photomontages. The significance of the effect on visual receptors is a combination of the sensitivity of the receptor as well as the magnitude of the change.

1.4.3.1 Visual Receptor Sensitivity

Visual Receptor Sensitivity depends on the occupation or activity of the people, as well the extent to which the attention is focused on views and visual amenity, according to the GLVIA Guidelines (2013). Visual receptor sensitivity is assessed as either being Very High, High, Medium or Low, based on the definition of descriptions set out in Table 1-4 below.

Table 1-4 Visual Receptor Sensitivity Assessment Criteria

Sensitivity of Visual Receptor(s)	Description
Very High	Included in this category are viewers that are primarily focused on views from this particular location, such as visitors to popular destinations identified for their outstanding views or residents in close proximity or medium proximity whose primary views will be in the direction of the development.
High	Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes

Sensitivity of Visual Receptor(s)	Description
Medium	Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Low	Includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.

1.4.3.2 Magnitude of Visual Change

The magnitude of the visual change resulting at each viewpoint is a combination of scale of the change, the extent of the area to be affected and the duration and reversibility of the effect, determined by reviewing the photomontage and wireframe images for each viewpoint. The magnitude of change is determined in accordance with the definitions and descriptions included in Table 1-5 below.

Table 1-5 Magnitude of Visual Change Assessment Criteria

Magnitude of Change	Description
Substantial	Substantial change, where the proposals would result in large-scale, prominent or very prominent change, leading to substantial obstruction of existing view or complete change in character and composition of the baseline though removal of key elements or addition of uncharacteristic elements which may or may not be visually discordant. This includes viewpoints where the proposed development is fully or almost fully visible over a wide extent, at close proximity to the viewer. This change could be long term or of a long duration.
Moderate	The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Slight	The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Negligible	Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.

1.4.3.3 Visual Effects Assessment Matrix

Table 1-6 below shows the significance of visual effects, arrived at by combining the visual receptor sensitivity and the magnitude of change classifications. Visual receptor sensitivity is shown in the left-

hand first column and magnitude of visual change is shown in the first row at the top of the table.

Table 1-6 Visual effects significance assessment matrix

	Substantial	Moderate	Slight	Negligible
Very High	Major	Major/Moderate	Moderate	Moderate/Minor
High	Major/Moderate	Moderate	Moderate/Minor	Minor
Medium	Moderate	Moderate/Minor	Minor	Minor/Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible

The determination of significance uses a seven-point scale, ranging from Major to Negligible. This seven-point scale is translated to the EPA impact assessment classifications of significance, as outlined in Table 1-3 below.

Table 1-7 EPA Impact Assessment Significance Classification for Visual Effects

Matrix Classification Significance	EPA Significance Classification	EPA (2017) Definition of Significance
Major	Profound	An effect which obliterates sensitive characteristics
Major/Moderate	Very significant	An effect, which by its character, magnitude, duration or intensity alters most of a sensitive aspect of the environment
Moderate	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate/Minor	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Minor	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Minor/Negligible	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Negligible	Imperceptible	An effect capable of measurement but without significant consequences

1.4.3.4 Residual Visual Effect

After determining the significance of the visual effect using the assessment matrix in Table 1-6 above, mitigating factors are taken into consideration to arrive at the final residual effect. In some cases, mitigating factors merit the residual effect being less than the one arrived at using the assessment matrix.

1.4.4 Assessing Cumulative Landscape and Visual Effects

1.4.4.1 Cumulative Landscape Effects

The SNH 2017 publication *Assessing the Cumulative Impact of Onshore Wind Energy Developments* identifies two principal areas of cumulative landscape effects, on the physical fabric of the landscape and on the landscape character. To this effect the guidelines state:

- *Cumulative effects on the **physical fabric** of the landscape arise when two or more developments affect landscape components such as woodland, dykes, rural roads or hedgerows. Although this may not significantly affect the landscape character, the cumulative effect on these components may be significant – for example, where the last remnants of former shelterbelts are completely removed by two or more developments.*
- *Cumulative effects on **landscape character** arise when two or more developments introduce new features into the landscape. In this way, they can change the landscape character to such an extent that they create a different landscape character type, in a similar way to large scale afforestation. That change need not be adverse; some derelict or degraded landscapes may be enhanced as a result of such a change in landscape character.*

Potential changes to the physical fabric outlined above are predominantly restricted to the proposed development site and the LCAs in which the site is located. Therefore, these landscape receptors will be assessed for cumulative landscape effects on the physical fabric of the landscape arising from the proposed development.

Cumulative effects on the landscape character will be assessed in the Landscape Character Areas (LCAs) that have theoretical visibility of the proposed development with particular emphasis on the two LCAs in which the proposed turbines will be located.

Table 1-8 below taken from *Cumulative Impact of Wind Turbines on Landscape and Visual Amenity* (Carmarthenshire County Council, 2013) will be used to assign a current status of the LCAs and whether the addition of the proposed turbines will change the status of any of the LCAs.

Table 1-8 Landscape types with regard to wind turbine development descriptions (Source Guidance on cumulative impact of wind turbines on landscape and visual amenity

	Landscape Status	Description
1	Landscape character area with no wind turbines	No turbines within an area and not visible except at a distance where they are very small or inconspicuous.
2	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s	Turbines are visible but are not at a scale, number, spacing or extent that makes them a defining/key characteristic. Turbines might be seen occasionally at close quarters but more often within background views.
3	Landscape character area with wind turbines	Turbines are located and visible and are at a scale and/or a spacing that makes them one of the defining/key characteristics. Turbines might be seen in the foreground, mid-ground or background. However, there would be other key characteristics which would be strong and there would be sufficient separation between turbines for views without turbines and other characteristics remaining dominant in these parts of the area.

	Landscape Status	Description
4	Wind turbine landscape	Turbines are frequent and may include extensive wind farms and are the dominant, defining characteristic but there is separation between groups of turbines. However, within these areas wind turbines are likely to be visible.
5	Windfarm	Landscape fully developed as a wind farm with no clear separation between groups of turbines.

Cumulative landscape effects are included in LCA Assessment Tables in Appendix 12.2 and summarised in the LVIA Chapter of the EIAR.

1.4.4.2 Cumulative Visual Effects

For this assessment, the SNH (2012) definition of cumulative effects as additional changes caused by a proposed development in conjunction with other similar developments, is used, however, this assessment also considers other types of developments. The definition in the DoEHLG Guidelines (2006) defines cumulative impacts in terms of wind farms, as the perceived effect on the landscape of two or more wind energy developments visible from any one place.

The GLVIA (2013) and SNH (2012) guidance also note cumulative visual effects can be experienced in combination, where two or more developments are visible from one viewpoint, as well as sequentially, where a viewer moves to another viewpoint and sees the same or different developments. The photomontage viewpoints illustrate combined visibility and analysis of the photomontages and route screening allows sequential visibility to be assessed.

The SNH 2017 publication *Siting and Designing Wind Farms in the Landscape* gives additional guidance on assessing combined visual effects in that it is states:

> *"A key factor determining the cumulative impact of wind farms is the distinct identity of each group. This relates to their degree of separation and similarity of design. This applies whether they are part of a single development, a wind farm extension, or a separate wind farm in a wider group. A wind farm, if located close to another of similar design, may appear as an extension; however, if it appears at least slightly separate and of different design, it may conflict with the other development. In these cases, if a landscape is unable to accommodate the scale of a combined development, wind farm groups should appear clearly separate. It is important to achieve a balance between wind farms and the undeveloped open landscape retained between them. Adequate separation will help to maintain wind farms as distinct entities. The separation distance required will vary according to the landscape characteristics."*

It also outlines that introducing turbines that are not similar in form, design, colour and scale may increase visual complexity and clutter.

Therefore, the cumulative assessment will concentrate on the above two issues:

- Whether the proposed turbines increase the spatial extent of turbines in the view
- Whether there is visual separation between the proposed turbines and other wind developments in the landscape
- Whether the contrast of different size and design between different wind developments creates visual clutter.

As cumulative visual effects depend on the aspect from which the turbines will be seen various viewpoints were selected to give a thorough overview of the how the proposed turbines will appear in conjunction to turbines already present.

The assessment of cumulative effects was included in the viewpoint assessment tables in Appendix 12.3 and summarised in the LVIA Chapter of the EIAR.

Table 1-9 Increase in Spatial Extent of Turbines in the View

Magnitude of Increase	Description
Significant	The spatial extent of turbines in the view is significantly increased by the proposed turbines.
Moderate	The spatial extent of turbines in the view is increased by a moderate amount by the proposed turbines.
Slight	The spatial extent of turbines in the view is slightly increased by the proposed turbines.
Negligible	There is no noticeable increase of the spatial extent of turbines in the view created by introduction of the proposed turbines to existing turbines already present in the view.

Table 1-10 Visual Separation

Magnitude of Change	Description
Complete	The proposed and existing turbines clearly separate and the proposed windfarm has a visual identity distinct from any other proposed or existing turbines.
Medium	The proposed and existing turbines have sufficient visual separation to allow the observer to identity proposed or existing turbines as separate developments.
Slight	The proposed and existing turbines appear behnd or in front of each other, but it the distance between them is visually apparent and therefore they do not appear as one wind farm
Negligible	The proposed and existing turbines appear alongside each other and appear as one large wind farm

Table 1-11 Difference in Scale

Magnitude of Change	Description
Substantial	Substantial differences in scale and design of the proposed and existing turbines are evident.
Moderate	The proposed and existing turbines have differences in scale and design that are evident, but not strongly contrasting
Slight	A difference in scale and design can be seen, but is not significant.
Negligible	Any difference in scale and design between proposed and existing turbines is barely discernible

1. LANDSCAPE CHARCTER ASSESSMENT TABLES

1.1 County Leitrim

LCA 11 - Corry Mountain	
Distance from Site to Nearest/Furthest Area of LCA	The proposed turbines are located within this LCA.
LCA Key Characteristics	› Extensive, mountainous uplands bordering Lough Allen. › Rough grazing on moorland hills and plateau. › Extensive areas of coniferous forestry. › Sparsely populated. Small houses associated with outbuildings are evident across many of the lower, gentler farmed slopes. › Impressive views from higher ground. › Moorland plateau retains sense of isolation despite access roads and infrastructure. › Field boundaries create strong patterns on lower hill slopes but show signs of dereliction in places. › Distinctive upland valleys sheltering small farming communities. › Semi-natural woodlands on steeper slopes and around farms.
Visibility within LCA	There is full visibility of the proposed turbines in the majority of this LCT, except for patchy or no visibility on the north-eastern slopes as indicated by the ZTV. Viewpoint 16 and 17 are located within this LCA.
Cumulative Baseline	There are existing and proposed wind farms within this LCA. These are: Garvagh Glebe, Black Banks, Monaneenatieve, Corrie Mountain and Spion Kop. Other wind farms in adjacent LCAs are also visible in parts of this LCA.
Cumulative Landscape Status	Landscape character area with wind turbines
Cumulative Landscape Effects	The proposed development will add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	Wind farm development is considered a key issue for the Corry Mountain LCA according to the *Landscape Assessment of County Leitrim* and therefore the sensitivity is considered **High**. It is a priority to site new wind farms/ communication masts close to existing development on the plateau to minimise impact on more remote areas of upland.
Magnitude of Change	**Moderate** A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not

	affect key characteristics. The effects could be long to medium term and/or partially reversible.
Significance of Effect	**High x Moderate = Moderate = Significant (EPA, 2017)** An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Limited theoretical visibility on north-eastern slopes › Due to forestation and roadside vegetation actual visibility will be significantly reduced

LCA 6 - Doons and Crockauns	
Distance from Site to Nearest/Furthest Area of LCA	This LCA is approximately 9.73 kilometres away from the nearest turbine at its closest point, and 20.25 kilometres at its furthest.
LCA Key Characteristics	› Varied limestone geology has created distinctive landform features, mountain profiles and scree slopes. › Contrasting land uses including extensive grazing, coniferous plantations and areas of both upland and lowland peat bog. › Semi-natural woodlands fringing Lough Gill. › Sparse settlement pattern of isolated farmhouses amongst areas of rush infested pasture. › Scrub encroachment and coniferous plantations obscure distinctive landform features. › Parkes Castle in an attractive lough side setting. › Lough Gill and its shores, noted for their nature conservation value.
Visibility within LCA	There is intermittent full theoretical visibility indicated within this LCA as evident by the ZTV. Viewpoint 6 is located within this LCA.
Cumulative Baseline	There are no existing wind farms within this LCA. However, other wind farms in adjacent LCAs are visible in parts of this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	Wind energy has not been highlighted as a key issue in the *Landscape Assessment of County Leitrim* hence the landscape sensitivity to wind farm development would be considered **Moderate.**
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level

	and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Moderate x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Theoretical visibility restricted to elevated areas of this LCA › Due to forestation and roadside vegetation actual visibility will be further reduced › Intervening distance (in excess of approx. 10km)

LCA 7 - Benboo	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 10.02 kilometres away from the closest point of the LCA, and approximately 14.33 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Rugged heath-clad hills form a distinctive mountain profile. › Smooth upland slopes are covered with heath and natural grassland. › Underlying bedrock is exposed where peaty soils are thinnest. › Streams in shallow valleys drain the hillsides and flow off the lower slopes into rivers which encircle the hard rock outcrop. › Gorges and streams shelter linear clusters of scrub and woodland. › Lower slopes are fringed by marginal, rushy pastures largely enclosed by fencing and coniferous plantations. Distinctive low stone walls are evident stretching up some hillsides forming long rectangular fields. › Roads encircle the mountain along which are located small, isolated farm cottages, often occupying sheltered locations and are surrounded by small copses. No settlement on the mountain itself. › Distinct lack of archaeological monuments. › Panoramic views over the adjacent lowlands.
Visibility within LCA	There is potential full visibility from the majority of this LCA as evident by the ZTV. No viewpoints are located within this LCA.
Cumulative Baseline	There are no existing wind farms within this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	The sensitivity of this landscape is **High** as the Benboo Mountains are distinctive within the landscape along with the field boundaries and heath-clad which stretch up the mountain.
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the

	landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Intervening distance (in excess of 10km)

LCA 8 - The Boleybrack Uplands	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 6.78 kilometres away from the closest point of the LCA, and approximately 20.24 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Extensive, mountainous uplands retain a sense of isolation. › Rough grazing on moorland hills and plateau. › Extensive areas of coniferous forestry. › Sparsely populated. Small houses associated with outbuildings are evident across many of the lower, gentler farmed slopes. › Impressive panoramic views from higher ground of surrounding mountains and lowlands. › Field boundaries creating strong patterns on lower hill slopes showing signs of dereliction in places. › Distinctive upland valley sheltering small farming communities. › Semi-natural woodlands on steeper slopes above O'Donnell's Rock.
Visibility within LCA	There is potential theoretical visibility of the proposed wind turbines from the south and east sides of this LCA as indicated by the ZTV. No viewpoints are located within this LCA.
Cumulative Baseline	The Tullynamoyle turbines and the Tullunamoyle wind farm extension are within this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	**High**, as wind farm development is considered a key issue for the Boleybrack Uplands as identified within the Leitrim Landscape Character Assessment.
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level

	and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Theoretical visibility restricted to the south-western part of this LCA › Due to forestation and roadside vegetation actual visibility will be further reduced in the lowland areas of this LCA

LCA 9 – The Northern Glens, Central Lowlands and Lough Allen	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 2.31 kilometres away from the closest point of the LCA, and approximately 28.33 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Undulating, drumlin covered lowlands and glens confined by sharp break in slope and mountainous areas. › Meandering rivers and loughs fed by streams from the surrounding hills, fringed by trees and extensive areas of wet pasture contrast with the surrounding patchwork of drumlin fields. › Small blocks of deciduous woodland and some coniferous plantations. › Linear settlements strung out along roads winding through the lowlands. › Local geological and topographical conditions give each glen its own particular character. › Major communication routes through the mountains. Major towns often sited where several routes meet. › Sense of enclosure within the drumlin swarms with occasional long views to the surrounding uplands providing orientation. › Castles are important local landmarks and an indication of the strategic importance of these landscapes in history.
Visibility within LCA	Patchy full theoretical visibility indicated by the ZTV in most of this LCA. Viewpoints 7, 8, 9, 10, 11 and 12 are located within this LCA.
Cumulative Baseline	There are no existing or permitted turbines within the landscape study area of this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	**Moderate** as the *'undulating landform and a robust hedgerow* network *allow the landscape to accommodate a degree of change'* (Landscape Assessment of County Leitrim).

Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Moderate x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Undulating topography coupled with forestation and roadside vegetation reduce visibility within this LCA.

LCA 10 – Sliabh An Iarainn	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 12.75 kilometres away from the closest point of the LCA, and approximately 26.61 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Extensive, mountainous uplands bordering Lough Allen. › Rough grazing on moorland hills and plateau. › Extensive areas of coniferous forestry. › Sparsely populated. Small houses associated with outbuildings are evident across many of the lower, gentler farmed slopes. › Impressive views from higher ground. › Moorland plateau retains sense of isolation despite access roads and infrastructure. › Field boundaries creating strong patterns on lower hill slopes showing signs of dereliction in places. › Distinctive upland valleys sheltering small farming communities. › Semi-natural woodlands on steeper slopes and around farms. › Concentration of sweathouses on some of the lower farmed slopes.
Visibility within LCA	There is intermittent full theoretical visibility evident within the LCA, with a large area of no visibility along the south-eastern shore of Lough Allen. Viewpoint 13 is located within this LCA.
Cumulative Baseline	There are currently no existing wind farms within this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	Due to the large coniferous plantations and deterioration of field boundaries the landscape sensitivity is considered **Moderate**.

Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Moderate x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Extensive forestation and roadside vegetation reduce visibility within the parts of this LCA adjacent to Lough Allen. › Clear views mainly restricted to the upper north-western slopes of Sliabh an Iarainn, at a distance in excess of approximately 14 km, which will be a mitigation factor

1.2 County Sligo

LCA 1 – Carrane Hill (Provisional)	
Distance from Site to Nearest/Furthest Area of LCA	There are two turbines within the LCA and the furthest point within this LCA situated 8.60 kilometres away from the nearest turbine.
LCA Key Characteristics	› Upland area surrounding Carrane Hill and its south-western slopes. › Extensive mountain moorland areas covering the summit. › Carrane Hill Bog has been subject to turf-cutting, but large areas of undisturbed moorland. › Fields occupy most of the lower slopes. › Commercial conifer plantation throughout this LCA › No settlements and sparsely populated. › A number of scenic routes in this LCA.
Visibility within LCA	Approximately a quarter of this LCA will have theoretical visibility and is restricted to the northern and eastern parts. Viewpoint 15 is located within this LCA.
Cumulative Baseline	There are numerous existing wind farms within this LCA. These are the Geevagh , Derrysallagh and Caranne Hill turbines.
Cumulative Landscape Status	Landscape character area with wind turbines
Cumulative Landscape Effects	The proposed development will add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.

Landscape Sensitivity to Wind Farm Development	As a significant proportion of this provisional LCA has been designated as *Sensitive Rural Landscapes* and *Visually Vulnerable Areas* in the *Landscape Characterisation Map,* the sensitivity is considered **High**.
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Limited theoretical visibility › Most of the areas of *Sensitive Rural Landscapes* will have no visibility of the proposed turbines › The focus of the scenic routes in this LCA is generally not in the direction of the proposed turbines.

LCA 2 Lough Arrow and Environs (Provisional)	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 5.51 kilometres away from the closest point of the LCA, and approximately 14.78 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Shores of Lough Arrow mainly forested with a mixture of conifer and deciduous trees › Generally well-maintained pattern of fields beyond the lake. › Away from the lough pockets of commercial forestry. › Elevated areas either side of Lough Arrow › To the south-west are the Bricklieve Mountains with panoramic views over Lough Arrow from Carrowkeel Megalithic Cemetery. › Area is not highly populated, but some ribbon development
Visibility within LCA	The eastern part of this LCA will have partial theoretical visibility on higher ground only, whereas west of Lough Arrow there is mainly full theoretical visibility until the ridgeline of the Bricklieve Mountains. Viewpoints 1 and 2 are located within this LCA.
Cumulative Baseline	There are currently no existing wind farms within this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.

Landscape Sensitivity to Wind Farm Development	Some parts of this provisional LCA have been designated as *Sensitive Rural Landscapes* and *Visually Vulnerable Areas* in the *Landscape Characterisation Map,* therefore, the sensitivity is considered **Moderate**.
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Moderate x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Theoretical visibility is limited in the parts of the LCA closest to the proposed development and distance will mitigate in the areas with highest theoretical visibility › Extensive forestation and roadside vegetation further reduce visibility within this LCA › *Sensitive Rural Landscapes* and *Visually Vulnerable Areas* will have partial theoretical visibility of the proposed turbines › The focus of the scenic routes in this LCA is generally towards Lough Arrow

LCA 3 – Eastern Lowlands (Provisional)	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 5.40 kilometres away from the closest point of the LCA, and approximately 12.73 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Characterised by extensive farmland, the pattern of the landscape is shaped by the tree lines and hedgerows of the field boundaries › Some forestry plantation › Gently undulating drumlin landscape › Many watercourses, including the Unshin, Douglas and Owenmore Rivers
Visibility within LCA	The drumlin landscape results in patchy, but mainly full theoretical visibility as indicated by the ZTV within this LCA. Viewpoints 3 and 4 are located within this LCA.
Cumulative Baseline	There are currently no existing wind farms within this LCA.
Cumulative Landscape Status	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s
Cumulative Landscape Effects	The proposed development will slightly add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.

Landscape Sensitivity to Wind Farm Development	Only a few small areas in this provisional LCA have been designated as *Sensitive Rural Landscapes* in the *Landscape Characterisation Map,* therefore, the sensitivity is considered **Low**.
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Low x Moderate – Minor/Negligible = Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Forestation and roadside vegetation reduce visibility within this LCA › No Visually Vulnerable Areas within this LCA › There are three scenic routes (Nos. 12,55 and 65), where no visibility could be established on the ground

LCA 4 – Lough Gill, Sligo and Environs (Provisional)	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 8.81 kilometres away from the closest point of the LCA, and approximately 20.15 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› The banks of Lough Gill are densely forested with mainly broadleaf trees. › On the northern shore the land undulates until Crockauns, Keelogyboy and Cope's Mountain. › To the south the land rises steeply from the banks of Lough Gill to Killery Mountain, Slieve Dangan and Slieve Daene, where there are panoramic views over the lake. › Apart from the lake shore and Lough Gill itself there are also recreation trails in Hazelwood Forest and Union Wood
Visibility within LCA	The southern slopes of Killery Mountain, Slieve Dangan and Slieve Daene have full theoretical visibility of the proposed turbines as well as the northern shoreline and hinterlands of Lough Gill. Other areas will have no visibility. Viewpoint 5 is located within this LCA.
Cumulative Baseline	There are currently no existing wind farms within this LCA.
Cumulative Landscape Status	No turbines within an area and not visible except at a distance where they are very small or inconspicuous.
Cumulative Landscape Effects	The proposed development will add to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.

Landscape Sensitivity to Wind Farm Development	As a significant proportion of this provisional LCA has been designated as *Sensitive Rural Landscapes* and *Visually Vulnerable Areas* in the *Landscape Characterisation Map,* the sensitivity is considered **High**.
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Forestation and roadside vegetation greatly reduce visibility within this LCA › Most *Visually Vulnerable Areas* will not have theoretical visibility › Just above half of *Sensitive Rural Landscape* areas will have theoretical visibility › Scenic routes in these areas are predominantly focussed on Lough Gill and the uplands in the southern part of this LCA

1.3 County Roscommon

LCA 1 – Lough Allen and Arigna Foothills	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 12.58 kilometres away from the closest point of the LCA, and approximately 14.88 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Quiet, sparsely populated broad valley defined by high mountains overlooking a very large lake. › The area forms a distinctively flat region between the Arigna Mountains and Lough Allen. › The land cover is predominantly peat bog and moorland, however there are areas of marginal farmland as well as small pockets of good quality arable land. › The R280 is the main regional road, with few other roads in the area.
Visibility within LCA	There is a narrow band of full theoretical visibility in the lower part of this LCA, decreasing to partial theoretical visibility. No viewpoints are located within this LCA.
Cumulative Baseline	There are currently no existing wind farms within this LCA.
Cumulative Landscape Status	No turbines within an area and not visible except at a distance where they are very small or inconspicuous.
Cumulative Landscape Effects	The proposed development will add slightly to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	Wind energy was not identified as a force for change in this LCA in the Roscommon Landscape Character Assessment, therefore the sensitivity is considered **Moderate**
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Moderate x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Limited theoretical visibility › The focus of scenic route in this LCA is towards Lough Allen and to a lesser extent the nearby Kilrononan Mountain.

LCA 14 - Arigna Mountains	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 8.54 kilometres away from the closest point of the LCA, and approximately 12.95 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› Arigna Mountains LCA is set on a rugged mountain steeped in mining history and providing some of the best views in the county. › The character area comprises rolling ridges, marginal farmland and coniferous forests. › There are numerous Scenic Routes and Scenic Views in the area, providing an elevated panorama of rolling farmland down to Lough Allen.
Visibility within LCA	There is a patch of full theoretical visibility in the centre of this LCA. No viewpoints are located within this LCA.
Cumulative Baseline	There are several existing wind farms within this LCA. These are the Altagowlan, Garvagh Tullyhaw, Seltannaveeny and Kilronan turbines.
Cumulative Landscape Status	Landscape character area with wind turbines
Cumulative Landscape Effects	The proposed development will add slightly to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	Wind energy was not identified as a force for change in this LCA in the Roscommon Landscape Character Assessment, therefore the sensitivity is considered **Moderate**
Magnitude of Change	**Slight** - The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Moderate x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Limited theoretical visibility › The focus of scenic of scenic routes and views in this LCA is towards Lough Allen

LCA 16 - Lough Key and Boyle River Network	
Distance from Site to Nearest/Furthest Area of LCA	The closest proposed turbine is approximately 11.92 kilometres away from the closest point of the LCA, and approximately 23.04 kilometres away from the furthest point of the LCA.
LCA Key Characteristics	› The overall image of this landscape is one of an extensive organically shaped lakeland fringed by broadleaf forest. › Undulating in an easterly direction this drumlin lakeland landscape is dominated by Lough Key and a series of other loughs, including Oakport Lough and Lough Eidin, all of which are linked by the Boyle River flowing in an easterly direction to connect to the River Shannon. › The ridgeline of the hills located just north of Lough Key mark the northern boundary, while the southern boundary is delineated by the N4. › The land cover in the northwest of the LCA is predominantly wet grassland with large areas of understorey forest, scrub and patches of heath. › In contrast the south eastern half of the LCA is made up of dry grassland with large areas of mature forest and patches of cut over raised bog and reclaimed raised bog.
Theoretical Visibility within LCA	There are patches of partial theoretical visibility within this LCA, yet this is minimal. No viewpoints are located within this LCA.
Cumulative Baseline	There are no existing wind turbines within this LCA.
Cumulative Landscape Status	No turbines within an area and not visible except at a distance where they are very small or inconspicuous.
Cumulative Landscape Effects	The proposed development will add very slightly to the cumulative landscape effects but not change the status identified above. Therefore, cumulative landscape effects are considered **Low**.
Landscape Sensitivity to Wind Farm Development	As the Roscommon Landscape Character Assessment has classed the landscape value of this LCA as Exceptional, the landscape sensitivity to wind energy is considered **Very High**.
Magnitude of Change	**Negligible** - a change affecting smaller areas of landscape character including the loss of some landscape elements or the addition of features or elements which are either of low value or hardly noticeable. The effects could be short term and/or reversible.
Significance of Effect	**Very High x Negligible = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Very limited theoretical visibility coupled with mainly dense roadside vegetation › Intervening distance (in excess of 12km) › All scenic routes and views are focussed on Lough Key, except one which will have no visibility of the proposed turbines.

Table 1 Viewpoints

VP No	Description	Grid Ref. (Irish Grid)
1	View from the summit of Bricklieve Mountain in Carrowkeel Megalithic Cemetery, situated in the townland of Carrowkeel, approximately 14.58 km south-west from the nearest turbine.	E 175,337 N 311,744
2	View taken from a section of the N4 national road designated as Scenic Route No. 3 in Sligo CDP directly east of Lough Arrow in the townland of Castlebaldwin, approximately 12.28 kilometres south-east of the nearest turbine.	E 176,687 N 312,850
3	View from the N4 national road in the townland of Doorly, approximately 14.19 kilometres east of the nearest turbine.	E 169,257 N 323,083
4	View from Radharc Na gCaisléan housing estate in the south of Collooney Town in the townland of Rathrippon, approximately 16.26 kilometres east of the nearest turbine.	E 167,949 N 325,527
5	View from car park off R286 on Lough Gill Drive marked as a Viewing Point over Lough Gill on OS map in the townland of Corwillick, approx. 12.8 kilometres north-west of the nearest turbine	E 177,241 N 335,006
6	View from Parke's Castle between the R286 regional road and Lough Gill, in the townland of Kilmore, approximately 12.89 kilometres north-west of the nearest turbine.	E 178,285 N 335,075
7	View from the townland of Dromahair taken on the R288, approximately 8.25 km north-west of the nearest turbine.	E 180,495 N 331,092
8	View from Co. Leitrim designated Scenic View No. 15 on unnamed local road in the townland of Carrigeencor, to the north of Carrigeencor Lough, approximately 10.66 km north of the nearest turbine.	E 183,367 N 334,416
9	View from McDermott Terrace housing estate in Manorhamilton Town in the townland of Manorhamilton, approximately 16.03 km north–west of the of the nearest turbine.	E 188,867 N 339,320
10	View from the R280 opposite the villages Catholic Church in the townland of Killarga, County Leitrim, approximately 7.56 kilometres north-east of the nearest turbine.	E 186,354 N 331,126
11	View from the townland of Drumkeeran, taken on the R280 road, approximately 4.52 km north-east of the nearest turbine.	E 190,530 N 324,520
12	View from Corry Strand on the shore of Lough Allen, in the townland of Cavan, approximately 8.77 kilometres east of the nearest turbine.	E 194,675 N 323,911
13	View from a local road off the R207 road in the village of Ballinagleragh in the townland of Drumreilly, approximately 14.94 km east of the nearest turbine.	E 199,891 N 323,043

VP No	Description	Grid Ref. (Irish Grid)
14	View from the R208 regional road in north of the town of Drumshanbo in the townland of Carriknabrack, approximately 16.05 km south-east of the nearest turbine.	E 197,347 N 311,167
15	View from local road designated as Scenic Route No. 66 in Sligo CDP in the townland of Ballynashee, approx. 5.0 kilometres south-south-east of the nearest turbine	E 187,753 N 317,957
16	View from an unnamed road in the townland of Beagh, approximately 1.37 kilometres north-west of the nearest turbine.	E 184,766 N 325,113
17	View from a local road in the townland of Tullynascreen, approximately 1.9 kilometres north-west of the nearest turbine.	E 182,162 N 325,179

Viewpoint 1 – Carrowkeel Megalithic Cemetery			
Viewpoint Description & Details	› View taken from the summit of in Carrowkeel Megalithic Cemetery, situated in the townland of Carrowkeel › 14.58 km south-west of the of the nearest turbine › Grid Reference: E175,337 N311,744 › No. of turbines visible: 9/10		
LCA & Sensitivity to Wind Farms	LCA 2 Lough Arrow and Environs (Prov.) - **Moderate**	**Visual Receptor(s) & Sensitivity**	Visitors-High
Description of 'Do Nothing Scenario'	This view taken at the peak of Bricklieve Mountain is within Carrowkeel Megalithic Cemetery with two passage tombs visible to the left in the foreground amongst the mountain moorland vegetation. At the bottom of the mountain there are middle distances views to Lough Arrow and its surrounding s consisting mainly of fields separated by hedges and tree lines interspersed with occasional buildings. There are clear long-distance views to the ridgeline of Carrne Hill and beyond that to Benbulbin and the rest of the Dartry Mountains. The existing Geevagh turbines can be seen just below the ridgeline and the existing and permitted Carrane Hill turbines appear from mid tower upwards near the summit. Further to the right the permitted Derrysallagh turbines will be visible, while other turbines though theoretically visible appear not visible with the naked eye.		
Proposed Photomontage Description	The proposed view shows all the proposed turbines visible behind the existing Geevagh turbines from Carrowkeel Megalithic Cemetery. Six will be visible from around hub height, while only the blade tips of the remaining four turbines will be seen crossing the horizon. While the proposed turbines will be taller than the nearby Carrane Hill turbines they do not appear so from this perspective. The spatial extent of the proposed turbines within the view is minor. The overall view is expansive and has the capacity to absorb the proposed development.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. **Mitigation Factors include:** › The existing, permitted and proposed wind turbines appear as three separate groups on the ridgeline rather than one continuous line › The Croagh turbines are at a significantly lower elevation to the other wind farms in the foreground and to the side, which mitigates any differences in tip heights. › Extensive screening provided by the ridgeline › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view		

Viewpoint 1 – Carrowkeel Megalithic Cemetery	
	and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › No residential visual receptors › Visitors to the Megalithic Cemetery will not be primarily be focused on the view, but on the adjacent passage tombs › Recreational visual receptors will be mainly seasonal and limited by weather conditions › Substantial proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Expansive view with the capacity to absorb the proposed development › Intervening distance (c16 km)
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 2 – Castlebaldwin - Scenic Route No.3			
Viewpoint Description & Details	› View taken from a section of the N4 national road designated as Scenic Route No. 3 in Sligo CDP directly east of Lough Arrow in the townland of Castlebaldwin › 12.28 km south-east of the of the nearest turbine › Grid Reference: E176,687 N312,850 › No. of turbines visible: 9/10		
LCA & Sensitivity to Wind Farms	LCA 2 Lough Arrow and Environs (Prov.) - **Moderate**	**Visual Receptor(s) & Sensitivity**	Residents-Low Motorised Traffic-Low
Description of 'Do Nothing Scenario'	Across the N4 the stone boundary wall and entrance to a farm can be seen. A hedgerow continues on from the wall to the right of the image. Beyond the stone wall a sparse hedgerow and fields used for pasture can be seen followed by farm buildings and a stand of mature trees. There are long-distance views to the upland area to the east of Lough Arrow and beyond this to the peak and ridgeline of Carrane Hill. The existing Geevagh turbines can be seen just below the ridgeline in the centre of the image and some of the permitted and existing Carrane Hill turbines are just visible near Carrane Hill Summit.		
Proposed Photomontage Description	Two of the proposed turbines will be visible just above hub height at the ridge, while the blades of seven more turbines may be seen appearing above the ridgeline. One turbine is entirely screened by landform. The spatial extent of the proposed turbines within the view is very limited.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. However, distance greatly mitigates the cumulative visual effects. **Mitigation Factors include:** › The existing, permitted and proposed wind turbines appear as three separate groups on the ridgeline rather than one continuous line › The Croagh turbines are at a significantly lower elevation to the other wind farms in the foreground and to the side, which mitigates any differences in tip heights. › Extensive screening provided by the ridgeline › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Low** Includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.		
Magnitude of Change	**Negligible** Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.		
Significance of Effect	**Low x Negligible = Negligible = Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences		

Viewpoint 2 – Castlebaldwin - Scenic Route No.3	
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › No adjacent residential visual receptors and road users will be travelling at speeds close to the speed limit of 100kmph on this straight section of road › Direction of travel of road user visual receptors is broadly perpendicular to direction of proposed turbines › Substantial proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c12 km) › The focus of the designated view is not towards the proposed development
Residual Effect (incl. mitigating factors)	**Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences.

Viewpoint 3 - Doorly			
Viewpoint Description & Details	› View taken off the N4 national road in the townland of Doorly, › 14.19 km east of the of the nearest turbine › Grid Reference: E 169,257, N 323,083 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 3 – Eastern Lowlands (Prov.) - **Low**	**Visual Receptor(s) & Sensitivity**	High-Speed Motorised Traffic-Low
Description of 'Do Nothing Scenario'	In this view across the N4, which is surrounded by grassed fields either side. In the mid-distance there are stands of trees to the right of the image and buildings and associated fencing in the towards the left. There are long-distance views to Carrane Hill in the centre of the view and to Slieve Dangan to the left of the image. The existing Garvagh Glebe turbines as well as the existing and permitted Carrane Hill Turbines are just discernible on the ridge in the centre of the image. There are other vertical elements in the form of telegraph poles and electricity pylons dotted around the landscape.		
Proposed Photomontage Description	All of the turbines will be visible from this location, although the turbine towers will be partially screened to varying degrees. The spatial extent of the proposed turbines is minor within this view		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. here is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. **Mitigation Factors include:** › The existing, permitted and proposed wind turbines appear as three separate groups on the ridgeline rather than one continuous line › The Croagh turbines are at a significantly lower elevation to the other wind farms in the foreground and to the side, which mitigates any differences in tip heights. › Screening provided by the ridgeline › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Low** - includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.		
Magnitude of Change	**Slight** - the proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**Low x Slight = Minor/Negligible = Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.		
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types.		

Viewpoint 3 - Doorly	
	› Small number of nearby visual receptors and road users will be travelling at speeds close to the speed limit of 100kmph on this straight section of road › Direction of travel of road user visual receptors is broadly perpendicular to direction of proposed turbines › A proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c14 km)
Residual Effect (incl. mitigating factors)	**Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences.

Viewpoint 4 – Collooney South			
Viewpoint Description & Details	› View from Radharc Na gCaisléan housing estate in the south of Collooney Town in the townland of Rathrippon › 16.26 km east of the of the nearest turbine › Grid Reference: E167,949 N325,527 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 3 – Eastern Lowlands (Prov.) - **Low**	**Visual Receptor(s) & Sensitivity**	GAA Club Visitors - Medium Residents-Medium
Description of 'Do Nothing Scenario'	This view from the Radharc Na gCaislean estate across Owenmore Gaels GAA Club with the pitches and associated infrastructure dominating the foreground. The GAA club is surrounded by groups of shrubs and mature trees with medium distance views to an industrial building in gaps in the vegetation. Beyond this building there is dense line of mature trees, above which there are long-distance views to Carrane Hill. Three groups of turbines can be seen on Carrane Hill. Carrane Hill turbine at the summit and Garvagh Glebe and Derrysallagh turbines are either side of these. The existing Tullynamoyle turbines can also been seen in the far distance to the left of the image.		
Proposed Photomontage Description	All of the proposed Croagh turbines will be seen from approximately mid-tower upwards in the distance and in the background. The spatial extent of the wind farm within the view is minor.		
Cumulative Effects	The proposed Croagh turbines do not expand the spatial extent of wind turbines from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. However, distance greatly mitigates the cumulative visual effects. **Mitigation Factors include:** › The existing, permitted and proposed wind turbines appear as three separate groups on the ridgeline rather than one continuous line › The existing turbines are barely discernible in the baseline photograph, however, they are somewhat visible from this location when on the ground. The effect is not significant due to the open expansive view › The proposed turbines are located to the fore of the existing turbines which provides for a more coherent spacing and heights comparison. › The Croagh turbines are at a lower elevation to the other wind farms in the background and to the side, which mitigates any differences in tip heights. › Screening provided by the ridgeline › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Medium** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view		

Viewpoint 4 – Collooney South	
	may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Significance of Effect	**Medium x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › View on outskirts of town at end of cul-de-sac, hence visual receptors will be limited to visitors to GAA grounds and small number of adjacent residences › A proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c16 km) is a significant mitigating factor minimising the potential for significant effects.
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 5 – Lough Gill			
Viewpoint Description & Details	› View from car park off Regional Road R286 on Lough Gill Drive marked as a Viewing Point over Lough Gill on OSi map in the townland of Corwillick. › 12.8 km north-west of the of the nearest turbine › Grid Reference: E177,241 N335,006 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 4 – Lough Gill, Sligo and Environs (Prov.) - **High**	**Visual Receptor(s) & Sensitivity**	Viewing point Visitors High Motorised Traffic-Medium
Description of 'Do Nothing Scenario'	This view looks across Lough Gill with the tarmacked parking area, low wall and shrubs in the foreground to the right of the image. There are medium-distance views to dense mixed forest on the opposite side of the lough. In the centre of the image there is a long-distance view to Carrane Hill. Although many existing and permitted turbines should be visible, they are not discernible in this image. The landscape on the far side of the lake is undulating and no man-made structures can be seen in this view.		
Proposed Photomontage Description	All turbines will be visible from this location. The two turbines furthest to the right will be fully visible, while most of the towers of the remaining eight turbines will be screened by intervening landform and vegetation. The spatial extent of the proposed wind farm within the view is minor		
Cumulative Effects (incl. mitigation factors)	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate** **Mitigation Factors include:** › The existing turbines are barely discernible in the baseline photograph, however, they are somewhat visible from this location when on the ground. The effect is not significant due to the open expansive view › The proposed turbines are located to the fore of the existing turbines which provides for a more coherent spacing and heights comparison. › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends		

Viewpoint 5 – Lough Gill	
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Substantial proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Direction of travel of road user visual receptors is broadly perpendicular to direction of proposed turbines › Intervening distance (c13km)
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 6 – Parke's Castle			
Viewpoint Description & Details	› View taken from Parke's Castle between the R286 regional road and Lough Gill, in the townland of Kilmore › 12.89 km north-west of the of the nearest turbine › Grid Reference: E 178,285, N 335,075 › No. of turbines visible: 8/10		
LCA & Sensitivity to Wind Farms	LCA 6 - Doons and Crockauns - **Low**	**Visual Receptor(s) & Sensitivity**	Visitors-High
Description of 'Do Nothing Scenario'	This view across Lough Gill was taken from the ramparts of Parke's Castle. In the foreground are treetops and views down to the carpark and jetty adjacent to Park's Castle. There are medium distance views to the near shore of Lough Gill with a mixture of pastoral fields and deciduous woodland beyond, with dense mixed forest on the opposite side of the lough. In the centre of the image there is a long-distance view to the summit of Carrane Hill with the existing and permitted Carrane Hill Turbines just visible. No other turbines can be seen in this view. The landscape on the far side of the lake is undulating and no man-made structures can be seen in this view.		
Proposed Photomontage Description	Six of the proposed Croagh turbines will be mainly fully visible with only part of the towers screened, two will be screened by intervening trees apart from the blade tips and the remaining two will be screened by landform and vegetation. Hence, the spatial extent of the proposed wind farm within the view is very limited.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. **Mitigation Factors include:** › The existing turbines are barely discernible in the baseline photograph, however, they are somewhat visible from this location when on the ground. The effect is not significant due to the open expansive view › The proposed turbines are located to the fore of the existing turbines which provides for a more coherent spacing and heights comparison. › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		

Viewpoint 6 – Parke's Castle	
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Recreational visual receptors will be mainly seasonal and limited by weather conditions › Substantial proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c13 km)
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 7 - Dromahair			
Viewpoint Description & Details	› View from the townland of Dromahair taken on the R288 outside the Caste Ct estate › 8.25 km north-west of the of the nearest turbine › Grid Reference: E 180,495 N331,092 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 9 – The Northern Glens, Central Lowlands and Lough Allen- **Moderate**	**Visual Receptor(s) & Sensitivity**	Residents-High Motorised Traffic-Low
Description of 'Do Nothing Scenario'	This view follows the R288 road in the southern outskirts of Dromahair Village. To the right of the road is an ivy-covered old stone wall with mature trees beyond. Left of the road is a pavement alongside ornamental planting and a row of residential houses behind a stone wall. There are long-distance views to Corry Hill and Carrane Hill above the road in the centre of the image. The existing Carrane Hill turbines can be seen on the crest of Carrane Hill as well as blade tips of the existing Garvagh Glebe above Corry Hill.		
Proposed Photomontage Description	All proposed Croagh turbines are visible in the proposed view shows clear visibility of the proposed Croagh Turbines. The two most eastern turbines will be screened to hub height by topography and vegetation, while the remaining turbines will be nearly completely visible. The proposed turbines will appear in front of the existing Carrane Hill turbines The spatial extent of the proposed turbines is not major in this view and is amplified by the view towards the turbines being framed by trees and buildings either side.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate** **Mitigation Factors include:** › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › The existing turbines are at a significant distance behind the proposed turbines and therefore the difference in height will be perceived as a difference in distance rather than scale. › Screening provided by the ridgeline and trees › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Medium** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		

Viewpoint 7 - Dromahair	
Significance of Effect	**Medium x Slight= Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › This was the only area in Dromohair, where clear visibility of the proposed turbines could be established › Majority of the residential visual receptors views are not directed towards the proposed turbines as can be seen in the photomontage › The road users will have a very brief view of the proposed turbines from this location until the road crosses the river, from where roadside vegetation will screen the proposed turbines. › Limited spatial extent of the proposed development within the view › Intervening distance (c8 km) › Framing of the view accentuates the visual effect › Some of the proposed development is screened
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

Viewpoint 8 - Carrigeencor			
Viewpoint Description & Details	› View taken from a local road in the townland of Carrigeencor, to the north of Carrigeencor Lough › 10.66 km north of the of the nearest turbine › Grid Reference: E 183,367, N 334,416 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 9 – The Northern Glens, Central Lowlands and Lough Allen- **Moderate**	**Visual Receptor(s) & Sensitivity**	Designated View-High Residents- High Motorised Traffic-Medium
Description of 'Do Nothing Scenario'	This view has been designated as protected view and prospect No. 15 in Leitrim CDP and is described as 'view towards Carrigeencor Lake from Local Roads LS08162 and LS08164'. In the foreground is a grassed lake foreshore and the lough to the south is surrounded by mixture of deciduous and coniferous. There are limited man-made structures within this viewpoint, apart from in the foreground of the image where there are electricity posts a lakeside storage shed and a manhole cover. The land is relatively flat in the nearby and medium distance landscape. In the far distance there are is a view to the ridge of Carrane Hill. Existing and permitted turbines although theoretically visible on the ridge are barely discernible.		
Proposed Photomontage Description	All the proposed turbines are visible from this location, most from mid-tower upwards, but four are screened just below hub height by landform and forestry. The spatial extent in the view is minor in this view.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. **Mitigation Factors include:** › The existing turbines are barely discernible in the baseline photograph, however, they are somewhat visible from this location when on the ground. The effect is not significant due to the open expansive view › The proposed turbines are located to the fore of the existing turbines which provides for a more coherent spacing and heights comparison. › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › Screening provided by the hill and tree line to the rear of the lake › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		

Viewpoint 8 - Carrigeencor	
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Substantial proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c11km) › Small number of residential receptors › Designated view is focused on the lake and the wind turbines do not obstruct or interrupt this view. They become a small part of the view in that they are partially visible at a distance in the background.
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 9 - Manorhamilton			
Viewpoint Description & Details	› View from McDermott Terrace housing estate in Manorhamilton Town in the townland of Manorhamilton › 16.03 km north-north-west of the of the nearest turbine › Grid Reference: E188867 N339320 › No. of turbines visible: 5/10		
LCA & Sensitivity to Wind Farms	LCA 9 – The Northern Glens, Central Lowlands and Lough Allen- **Moderate**	**Visual Receptor(s) & Sensitivity**	Local residents- High
Description of 'Do Nothing Scenario'	This viewpoint is within McDermott Terrace housing estate and looks down through the adjacent Benbo Heights housing estate with low boundary walls surrounding the front gardens either side of the street. Hence, the character of the foreground of the view is suburban in character. Beyond this, houses are dotted around an undulating rural farmland landscape with a mixture of mature trees and pastoral fields. This landscape pattern continues to the distant horizon on the right of the image, while to the left steep northern slopes up to Larkfield Hill dramatically contrast. Although the existing Geevagh turbines are indicated in the wireframe image, they are not discernible in the image.		
Proposed Photomontage Description	The proposed view indicates that five of the proposed Croagh turbines will be screened by topography and vegetation. The blade tips of two turbines will appear above the slope of Larkfield Hill. Two turbines will appear above hub height and a single turbine will be fully visible.		
Cumulative Effects	Cumulative visual effects do not arise in this viewpoint.		
Sensitivity of Visual Receptor(s)	**High** - includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** - the proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends		
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › This was the only area in Manorhamilton, where clear visibility of the proposed turbines could be established › Majority of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c16km) › Majority of the residential visual receptors views are not directed towards the proposed turbines		

Viewpoint 9 - Manorhamilton	
	› The proposed turbines are significantly lower than the northern slopes of Larkfield Hill
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 10 - Killarga			
Viewpoint Description & Details	› View taken from the R280 in the village of Killarga, in the townland of Killarga › 7.56 km north-east of the of the nearest turbine › Grid Reference: E 186,354, N 331,126 › No. of turbines visible: 8/10		
LCA & Sensitivity to Wind Farms	LCA 9 – The Northern Glens, Central Lowlands and Lough Allen- **Low**	**Visual Receptor(s) & Sensitivity**	Village Centre-High Residents-High Motorised Traffic- Low
Description of 'Do Nothing Scenario'	This view was taken adjacent to Killarga church and looks between the local pub and post office and a residential house on the other side of the R280. These buildings frame medium and long-distance views. In the image foreground is the R280 with pavement, retaining wall and a densely vegetated embankment to the right. To the left of the image a car park can be seen bounded by a wall and mature trees behind. A sloping field can be seen in the medium distance ending in a hedgerow and groups of mature trees. Beyond this there are long-distance views to Carrane Hill, where the existing Garvagh Glebe and the existing and permitted Carrane Hill turbines are visible.		
Proposed Photomontage Description	Eight turbines will be visible from this location the other two being screened by buildings. The eight turbines will be generally visible from mid-tower upwards, although a treeline on an intervening ridge provides substantial screening. The spatial extent of the wind farm within the view is moderate.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines moderately from this location. There is a **Slight** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. **Mitigation Factors include:** › The proposed turbines are located to the fore of the existing turbines which provides for a more coherent spacing and heights comparison. › The Croagh turbines are at a lower elevation to the other wind farms in the background and to the side, which mitigates any differences in tip heights. › Screening provided by the ridgeline › Distance mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		

Viewpoint 10 - Killarga	
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Limited adjacent residential visual receptors › A proportion of the proposed development is screened › Limited spatial extent of the proposed development within the view › Intervening distance (c8 km) › Framing of the view accentuates the visual effect however the rise in topography in the middle ground as well as the intermittent mature trees interrupts the view and means that the turbines do not appear to dominate.
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

Viewpoint 11 - Drumkeeran			
Viewpoint Description & Details	› View from the R280 regional road in the village of Drumkeeran in the townland of Drumkeeran › 4.78 km east-north-east of the of the nearest turbine › Grid Reference: E190530 N324520 › No. of turbines visible: 4/10		
LCA & Sensitivity to Wind Farms	LCA 9 – The Northern Glens, Central Lowlands and Lough Allen- **Moderate**	**Visual Receptor(s) & Sensitivity**	Residents-Medium Motorised Traffic-Low
Description of 'Do Nothing Scenario'	The view looks across and along the R280 with adjacent pavements, road infrastructure, grassed verges, mature trees and a stone wall on the far side. Beyond the stonewall the ground level is lower for a short stretch and then rises to the northern foothills of Corry Mountain. Above the near ridgeline there is a long-distance view to a small part of Carrane Hill. The hill slope is a mixture of rough-grazing fields and broadleaf and coniferous woodland. Some of the houses on the outskirts of Drumkeeran can be seen in parts of the image. A number of existing turbines are visible on the brow of the hill.		
Proposed Photomontage Description	One of the proposed Croagh turbines can be seen from mid tower upwards and the blade tips of another will cross the horizon. All other proposed turbines will be screened by landform and vegetation.		
Cumulative Effects	The proposed Croagh turbines do not expand the spatial extent of wind turbines from this location. There is a **Slight** visual separation between existing and proposed turbines and the difference in scale is **Slight**. **Mitigation Factors include:** › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › Screening provided by ridgeline		
Sensitivity of Visual Receptor(s)	**Medium** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**Medium x Slight= Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities		
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › View on outskirts of village with limited residential visual receptors › Vast majority of the proposed development is screened by topography		

Viewpoint 11 - Drumkeeran	
	› Very limited spatial extent of the proposed development within the view › Direction of travel of road user visual receptors is broadly perpendicular to direction of proposed turbines
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 12 – Corry Strand			
Viewpoint Description & Details	› View taken Corry Strand on the shore of Lough Allen. This location is situated within the townland of Cavan, › 8.77 km north-east of the of the nearest turbine › Grid Reference: E 194,675, N 323,911 › No. of turbines visible: 8/10		
LCA & Sensitivity to Wind Farms	LCA 9 – The Northern Glens, Central Lowlands and Lough Allen- **Low**	**Visual Receptor(s) & Sensitivity**	Visitors-High
Description of 'Do Nothing Scenario'	In the foreground of the view is the northern part of Lough Allen and its densely forested shoreline. The far shore seen in the medium distance also has dense broadleaved woodland interspersed occasionally by lakeside meadows. From the shore the land rises gently at first then more steeply to Corry Mountain, which is covered in a mixture of fields and coniferous forest on the lower slopes and mountain moorland on the summit. Multiple existing and permitted windfarms can be seen on the ridgeline from this location.		
Proposed Photomontage Description	Eight turbines will be visible from this location. Only the blade tips of four turbines will be visible, three will be visible above hub-height and one from mid-tower upwards. The spatial extent of the proposed wind farm within the view is minor.		
Cumulative Effects	The proposed Croagh turbines do not expand the spatial extent of wind turbines from this location. There is a **Slight** visual separation between existing and proposed turbines and the difference in scale is **Slight**. **Mitigation Factors include:** › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › Screening provided by the ridgeline and trees mitigates cumulative effects › Distance mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**High x Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends		
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types.		

Viewpoint 12 – Corry Strand	
	› Recreational visual receptors will be seasonal and limited by weather conditions › Substantial proportion of the proposed development is screened with only partial visibility of 3-4 turbines. › Limited spatial extent of the proposed development within the view › Intervening distance (c9 km)
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 13 – Ballinagleragh Village			
Viewpoint Description & Details	› View taken from a road off the R207 road in the village of Ballinagleragh in the townland of Drumreilly › 14.94 east of the of the nearest turbine › Grid Reference: E 199,891 N323,043 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 10 – Sliabh An Iarainn - **Moderate**	**Visual Receptor(s) & Sensitivity**	Residents-Medium Motorised Traffic-Low
Description of 'Do Nothing Scenario'	This view looks down a local road bordered by a low hedge to the left and a boundary wall to the right in the eastern part of Ballinagleragh Village. There are gardens and fields either side of the road followed by a line of mature trees that screen most of the valley around Lough Allen. There are long-distance views to the Corry Mountain ridgeline between the trees where a long row of existing and permitted wind turbines can be seen.		
Proposed Photomontage Description	The proposed photomontage shows all ten proposed turbines behind the existing Garvagh Glebe turbines. The proposed turbines will generally be visible from hub height upwards. While the proposed turbines will be taller than the existing turbines they do not appear so from this perspective as they have been sited at lower elevations to the existing Garvagh Glebe turbines.		
Cumulative Effects	The proposed Croagh turbines do not expand the spatial extent of wind turbines from this location. There is a **Slight** visual separation between existing and proposed turbines and the difference in scale is **Slight**. **Mitigation Factors include:** › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights. › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Medium** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**Medium x Slight= Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities		
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › View from outskirts of village with limited residential visual receptors › Significant proportion of the proposed development is screened behind the Corry Mountain ridgeline		

Viewpoint 13 – Ballinagleragh Village	
	› Very limited spatial extent of the proposed development within the view › Intervening distance (c15 km)
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 14 – Drumshanbo Town			
Viewpoint Description & Details	› View taken off the R208 regional road in north of the town of Drumshanbo in the townland of Carriknabrack › 16.05 south-east of the of the nearest turbine › Grid Reference: E 197,347 N 311,167 › No. of turbines visible: 8/10		
LCA & Sensitivity to Wind Farms	LCA - 13 South Leitrim Drumlins & Shannon Basin - **Moderate**	**Visual Receptor(s) & Sensitivity**	Residents-Low Motorised Traffic-Medium
Description of 'Do Nothing Scenario'	The view is along the R208 at the end of which is a building in the middle distance. To the left of the road is a pavement and boundary walls and trees belonging to the adjacent Drumshanbo Mart. There is roadside verge and a well-maintained hedge to the right of the R208 in the foreground, beyond which an undulating, overgrown field bordered by some trees. Much of the middle ground is screened by the roadside hedgerow and nearby trees, but the rooftops of residential houses and numerous electricity pylons can be seen amongst tree crowns. While the terrain gently undulates in the until the middle distance, Kilronan Mountain can be seen followed by Carrane Hill, which are separated by a valley from Corry Mountain to the right. A large group of turbines are spread over Corry Mountain and two clusters can be seen on Kilronan Mountain, while the turbines on Carrane Hill are barely discernible in the distance.		
Proposed Photomontage Description	Four of the proposed turbines and three of the blade tips will be partially visible from this viewpoint in the valley between the two mountain ranges. The other five proposed turbines are screened by landform and vegetation. The spatial extent of the proposed turbines is very minor within the view and the proposed turbines are at a significant distance from the receptors here.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is **Complete** visual separation between existing and proposed turbines and the difference in scale is **Negligible**. **Mitigation Factors include:** › Complete visual separation from other wind farms › Extensive screening provided by the ridgeline and trees › The Croagh turbines are at a significantly lower elevation to the other wind farms in the background, which mitigates any differences in tip heights. › Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Low** Includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.		
Magnitude of Change	**Negligible** - any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.		

Viewpoint 14 – Drumshanbo Town	
Significance of Effect	**Low x Negligible = Negligible = Imperceptible (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › No adjacent residential visual receptors › Substantial proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view › Intervening distance (c16 km)
Residual Effect (incl. mitigating factors)	**Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences.

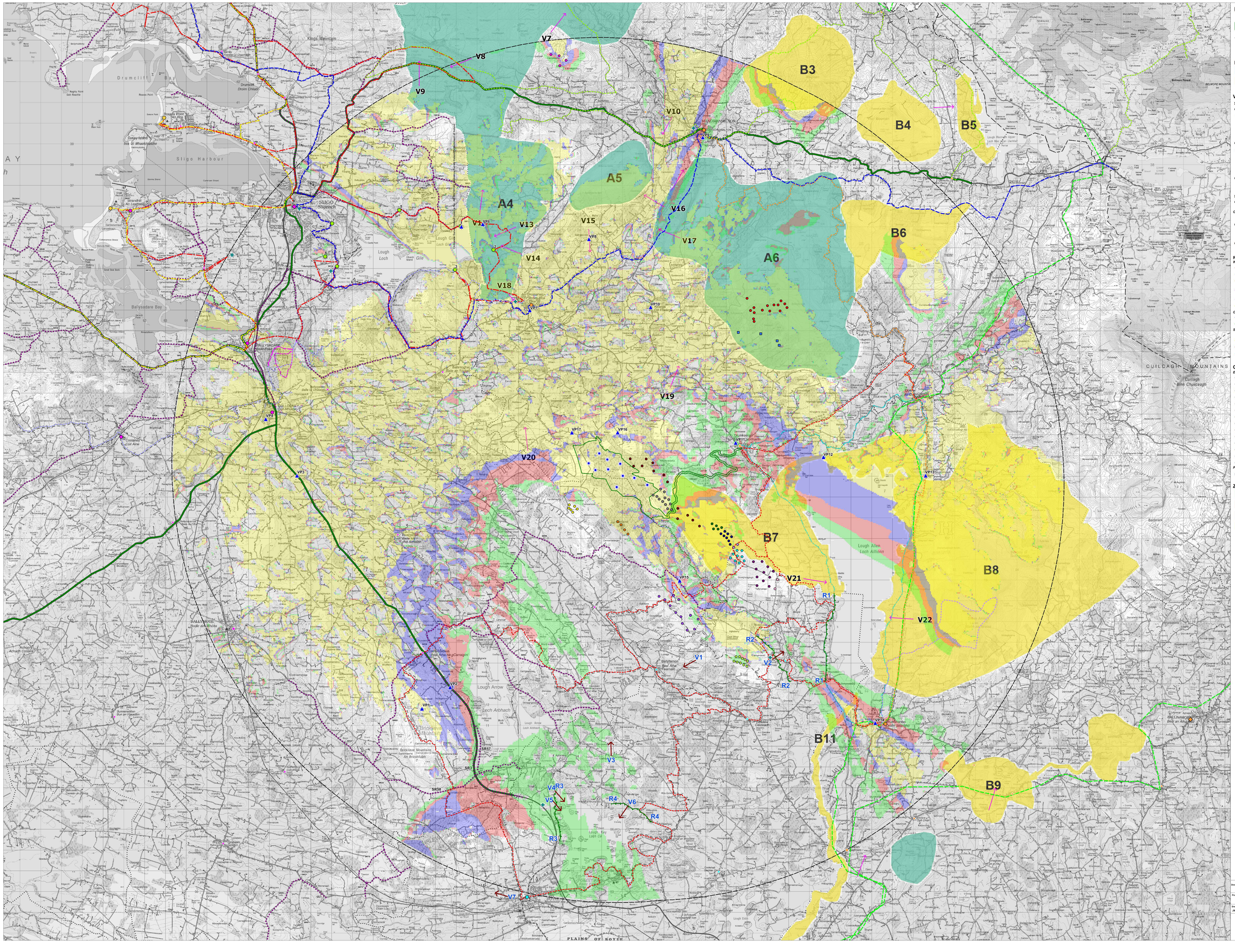
Viewpoint 15 – Ballynashee - Scenic Route No.66			
Viewpoint Description & Details	› View from local road designated as Scenic Route No. 66 in Sligo CDP in the townland of Ballynashee › 4.96 south-east of the of the nearest turbine › Grid Reference: E 187,753 N 317,957 › No. of turbines visible: 4/10		
LCA & Sensitivity to Wind Farms	LCA 1 - Carrane Hill (Prov.) - **High**	**Visual Receptor(s) & Sensitivity**	Residents-Low Motorised Traffic-Low Scenic Route-High
Description of 'Do Nothing Scenario'	This view looks out over the Arigna River Valley to the south-western slopes of Corry Mountain and its ridgeline extending to the north-west. To the right of the image the view follows the local road bordered by a fence line to the right and with the peak of Carrane Hill seen in the distance. From the road the land slopes down to the Arigna River with landcover in the foreground being predominantly rough-grazing fields and coniferous plantation in the middle distance. This landcover is mirrored on the other side of the valley, but the top of Corry Hill is covered in moorland. Many existing and permitted wind turbines can be seen in the medium distance along the Corry Mountain ridge.		
Proposed Photomontage Description	Four of the proposed turbines will be visible from this viewpoint with the remaining turbines being screened by landform and vegetation. Hence, the spatial extent of the proposed turbines within the view is not significant.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines slightly from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Slight**. **Mitigation Factors include:** › The proposed wind farm is in keeping with siting design requirements as it follows the ridgeline in the same manner as the existing and permitted turbines. › Extensive screening provided by the ridgeline and trees › The Croagh turbines are at a lower elevation to the other wind farm in the background which mitigates any differences in tip heights.		
Sensitivity of Visual Receptor(s)	**Medium** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.		
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**Medium x Slight= Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities		

Viewpoint 15 – Ballynashee - Scenic Route No.66	
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › No nearby residential visual receptors and road users are infrequent › Large proportion of the proposed development is screened by the Carrane Hill ridgeline to the left of the image. This screening effect continues as you travel along the roadway towards the site. › Limited spatial extent of the proposed development within the view › Designated view is focused on Carrane Hill, which is to the left of the proposed turbines
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

Viewpoint 16 - Beagh			
Viewpoint Description & Details	› View taken from a road in the townland of Beagh, › 1.37 km north-west of the of the nearest turbine › Grid Reference: E 184,766, N 325,113 › No. of turbines visible: 10/10		
LCA & Sensitivity to Wind Farms	LCA 11 - Corry Mountain - **High**	**Visual Receptor(s) & Sensitivity**	Residents-Medium Motorised Traffic-Medium
Description of 'Do Nothing Scenario'	The view shows a road rising up the hill to the left of the image with fields either side of the road. Coniferous plantation forestry dominates the landscape in the middle distance except for two expanses of moorland towards the left of the image. Five of the existing Garavagh Glebe turbines can be seen on the ridge to the left of the image all other existing and permitted turbines are screened by landform and vegetation. Other man-made structures are electricity pylons and a few residential houses.		
Proposed Photomontage Description	All turbines will be visible from this location, albeit three will be wholly screened save for the blade tips. Of the seven other turbines two will be visible above hub height and five from approx. mid-tower upwards. The rise in the landform from the foreground into the middle ground obstructs open views of the proposed turbines. The mature forestry present on the ridgeline also acts to further screen the turbines. The spacing and heights of the turbines appear as a coherent development from this location and due to the screening and positioning behind the ridgeline don't dominate their surroundings. The spatial extent of the proposed wind farm in the image is significant which is not unexpected as this location is so close to the proposed development.		
Cumulative Effects	The proposed Croagh turbines expand the spatial extent of wind turbines significantly from this location. There is a **Slight** visual separation between existing and proposed turbines and the difference in scale is **Slight**. **Mitigation Factors include:** › The proposed turbines are located to the fore of the existing turbines which provides for a more coherent spacing and heights comparison. › The Croagh turbines are at a lower elevation to the other wind farms in the background and to the side, which mitigates any differences in tip heights. › Extensive screening provided by the ridgeline and mature forestry		
Sensitivity of Visual Receptor(s)	**Medium** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.		
Magnitude of Change	**Moderate** - the change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.		

Viewpoint 16 - Beagh	
Significance of Effect	**Medium x Moderate = Moderate/Minor = Moderate (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Limited nearby residential visual receptors › Significant proportion of the proposed development is screened by the rise in the landform from the foreground into the middle ground obstructing open views of the proposed turbines. The mature forestry present on the ridgeline also acts to screen further the turbines. › Low volumes of traffic on this local road
Residual Effect (incl. mitigating factors)	**Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends

Viewpoint 17 - Tullynascreen			
Viewpoint Description & Details	› View taken from a road in the townland of Tullynascreen › 1.9 km north-west of the of the nearest turbine › Grid Reference: E 182,162, N 325,179 › No. of turbines visible: 6/10		
LCA & Sensitivity to Wind Farms	LCA 11 - Corry Mountain- **High**	**Visual Receptor(s) & Sensitivity**	Motorised Traffic - Low
Description of 'Do Nothing Scenario'	There are fields bounded by hedgerows either side of the road. Tree lines, hedgerow and groups of trees and shrubs are dotted around the landscape while there is dense coniferous plantation on higher ground. The land dips to the right of the road and then rises continuously. Telegraph poles and buildings can also be seen in this view		
Proposed Photomontage Description	The wireframe shows that all turbines are potentially visible from this location however there is only partial visibility of six turbines shown in the photomontage. One turbine will be visible from mid tower upwards, while only blade tips of the others will be visible. The spatial extent in this view is minor due to extensive screening by intervening topography and multiple layers of vegetation.		
Cumulative Effects	Cumulative visual effects do not arise in this viewpoint.		
Sensitivity of Visual Receptor(s)	**Low** Includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.		
Magnitude of Change	**Moderate** - the change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.		
Significance of Effect	**Low x Moderate = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.		
Mitigation Factors	› Siting and design were developed in accordance with the DoEHLG guidelines (2006) for Mountain Moorland landscape character types. › Small number of nearby visual receptors › A large proportion of the proposed development is screened › Very limited spatial extent of the proposed development within the view		
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.		



Map Legend

- Proposed Turbine
- EIAR Site Boundary
- Visual Baseline and Landscape Designation Study Area
- Viewpoint Locations

Landscape Designations

- Areas of Outstanding Natural Beauty
- Areas of High Visual Amenity

Visual Baseline

Settlements

County Leitrim
- Tier 2A Centres
- Tier 2B Centres
- Tier 3 Centres
- Tier 4 Centres

County Sligo
- Gateway City
- Gateway Satellites
- Key Support Towns
- Villages

County Roscommon
- Tier 2
- Tier 4

Scenic Routes and Views

County Leitrim
- Protected Views and Prospects

County Sligo
- Scenic Routes

County Roscommon
- Scenic Views
- Scenic Routes

OSI Viewing Points
- Viewing Point marked on OSi map

Routes & Destinations

Walking Routes
- Miners Way
- Sligo Way
- Leitrim Way
- Union Rock Trail / Oak Wood Trail
- Sliabh an Iarainn Loop
- Northern Glens Trail

Cycle Trails
- Northwest Cycle Trail
- Kingfisher Cycle Loop

Scenic Drives
- Wild Atlantic Way Discovery Point
- Wild Atlantic Way
- Lough Gill Scenic Drive
- Lough Allen Scenic Drive

Cumulative Baseline

Existing Turbines
- Altagowlan
- Black Banks
- Caranne Hill
- Carrickhenney
- Corrie Mountain
- Garvagh Glebe
- Garvagh Tullyhaw
- Geevagh
- Kilronan
- Monaeneantaeve
- Seltannaveeny
- Spion Kop
- Tullynamoyle
- Derrysallagh

Permitted Turbines
- Tullynamoyle Extension

Zone of Theoretical Visibility

- 1 to 3 turbines
- 4 to 6 turbines
- 7 to 8 turbines
- 9 to 10 turbines

Drawing Title:	Appendix 12-4 ZTV, Viewpoints, Landscape Designations and Cumulative Baseline				
Project Title:	180511 - Croagh Wind Farm EIAR				
Drawn By: JM	Checked By: EM	Scale: 1:55,000	Date: 30/06/2020	Project No: 180511	Drawing No.: Figure 12-4

MKO
Planning and Environmental Consultants
Tuam Road Galway,
Ireland H91 VW84
+353 (0) 91 735611
Email: info@mkoireland.ie
Website: www.mkoireland.ie



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.6 Location 1 - Bend on R280, autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	29.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

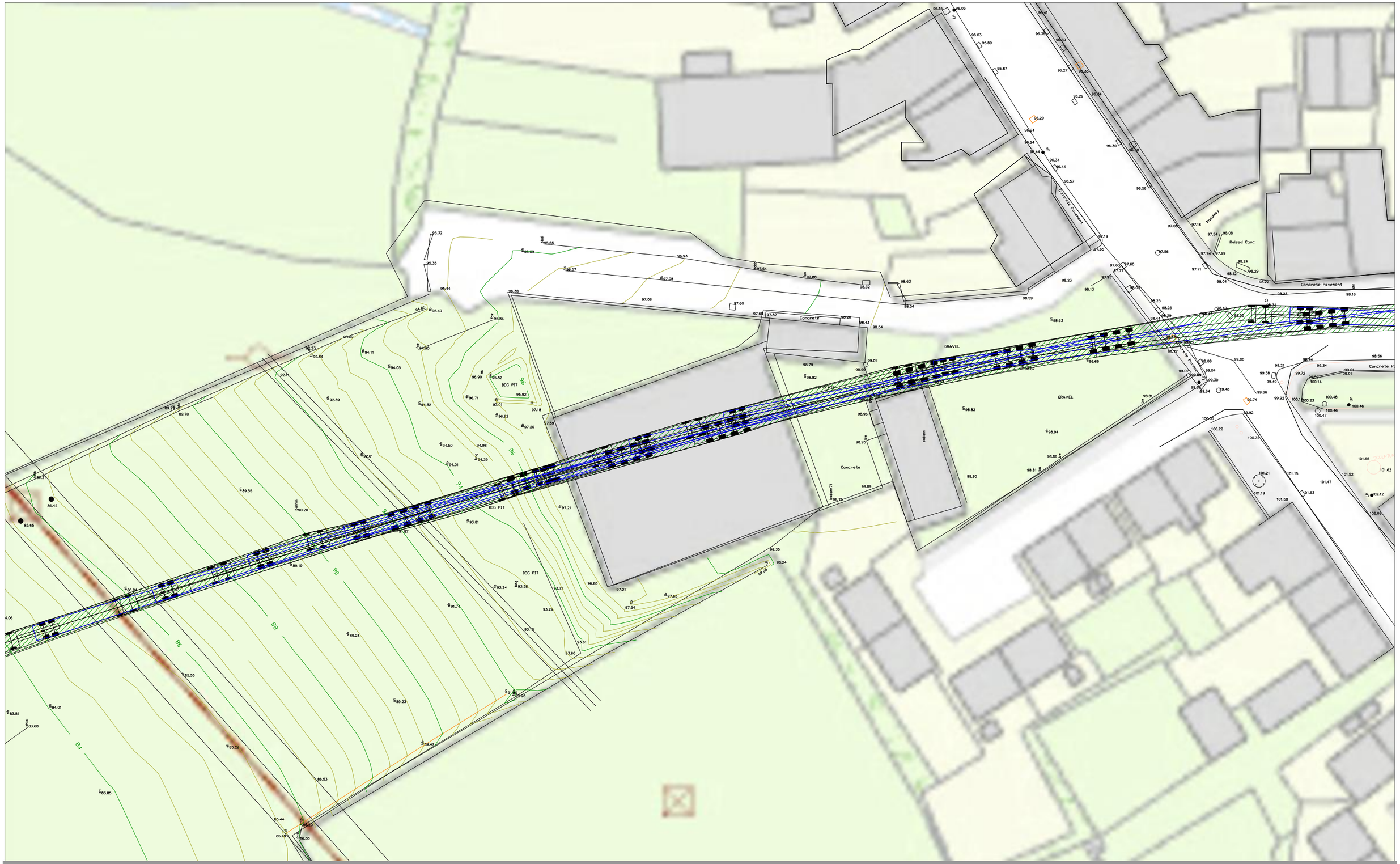
PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.7 Location 1 - Bend on R280, autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	29.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

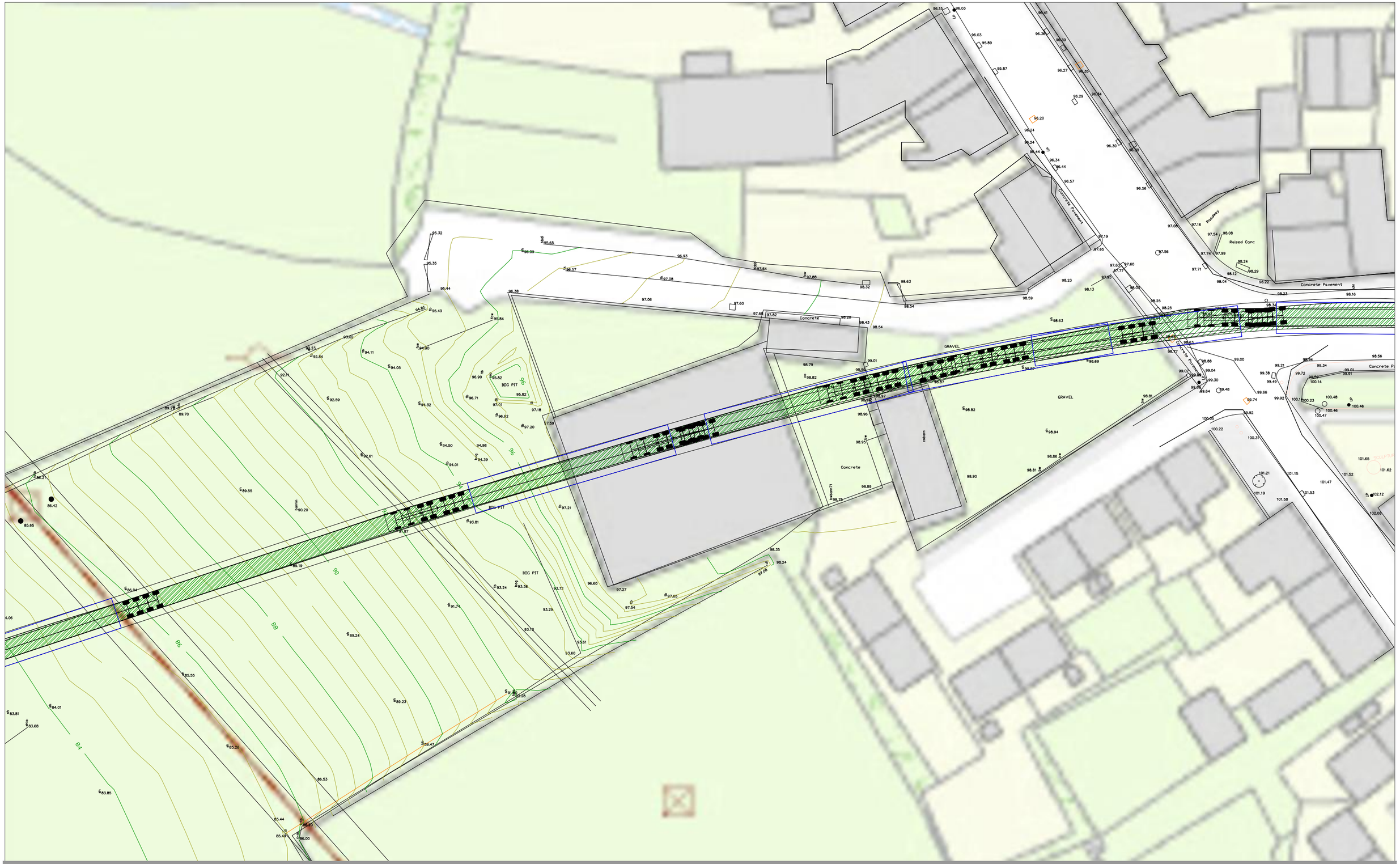
PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.8 Location 2 - Access Junction A - R280, for turbine artics only, autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:500
PROJECT NO: 7410	DATE: 29.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.9 Location 2 - Access Junction A - R280, for turbine artics only, autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:500
PROJECT NO: 7410	DATE: 29.06.20	DRAWN BY:	AL

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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.10 Location 3 - Access Junction B - L4282, for turbine artics only, autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 29.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
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NOTES:

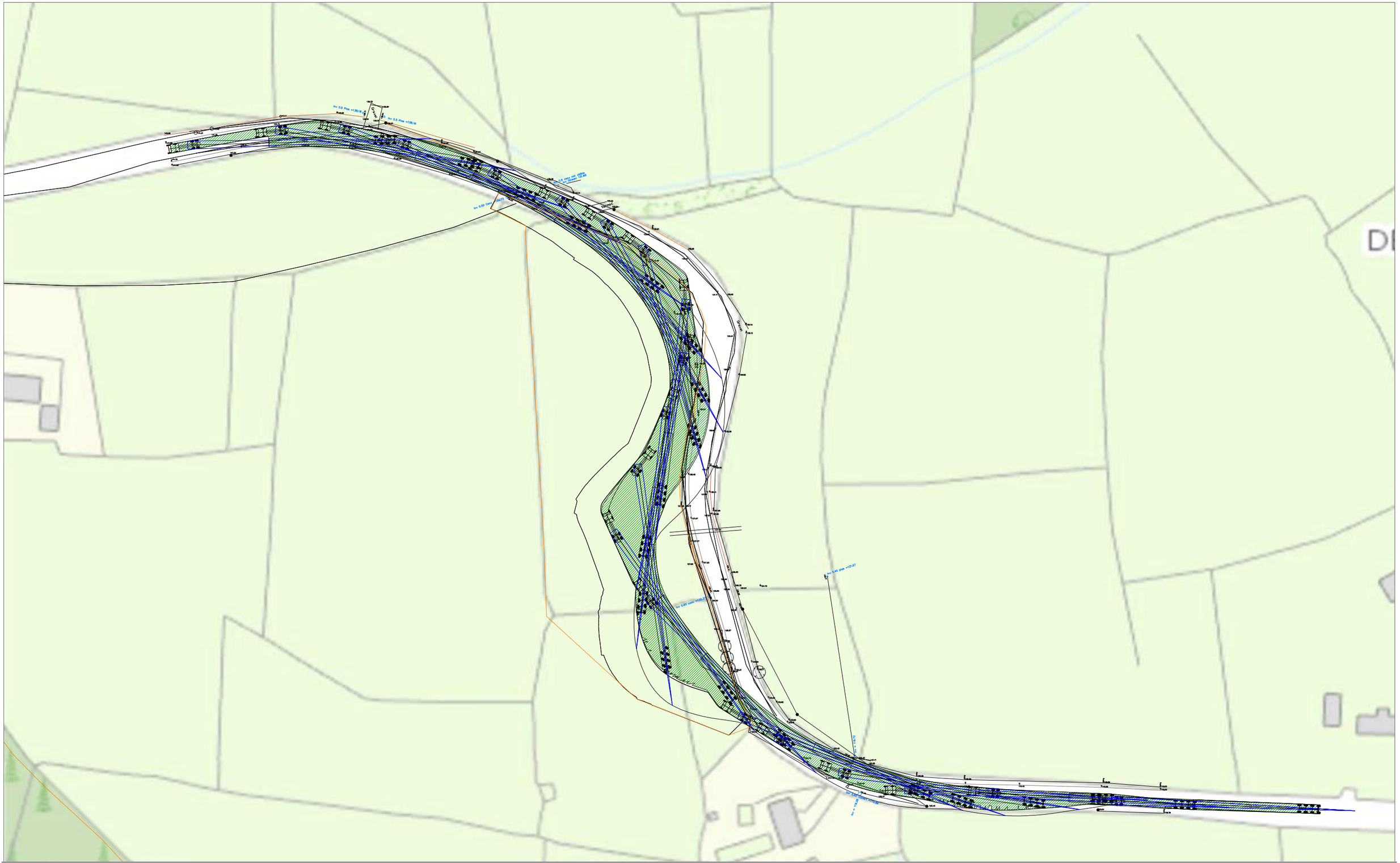
PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.11 Location 3 - Access Junction B - L4282, for turbine artics only, autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte		SCALE: 1:1000
PROJECT NO: 7410	DATE: 29.06.20		DRAWN BY: AL

ALAN LIPSCOMBE
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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.12 Location 4 - L4282, autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte		SCALE: 1:1000
PROJECT NO: 7410	DATE: 26.06.20		DRAWN BY: AL

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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.13 Location 4 - L4282, autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

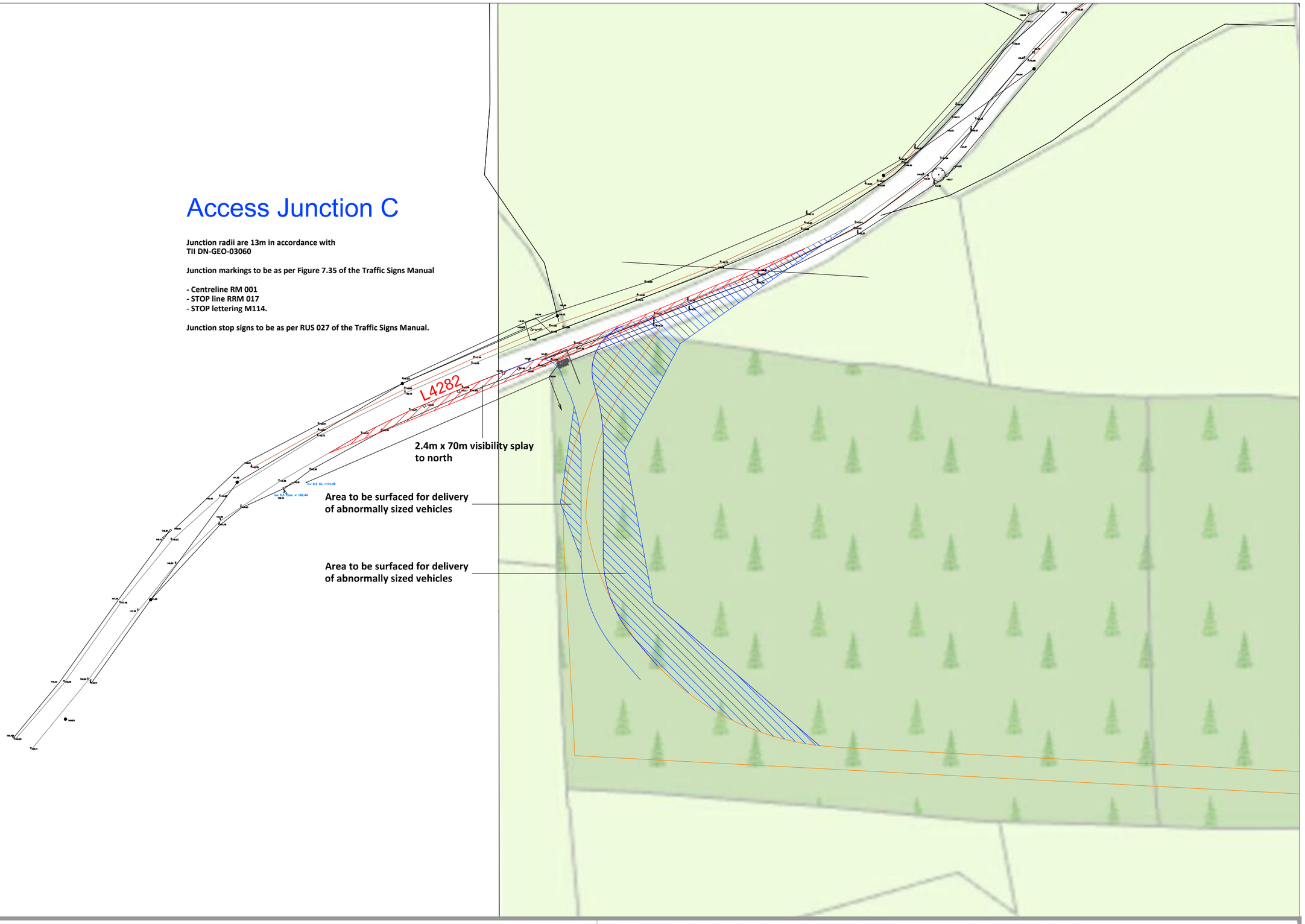
Access Junction C

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.14 Location 5 - Access C - L4282 - Turbine access and general construction access, proposed layout and visibility splays

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

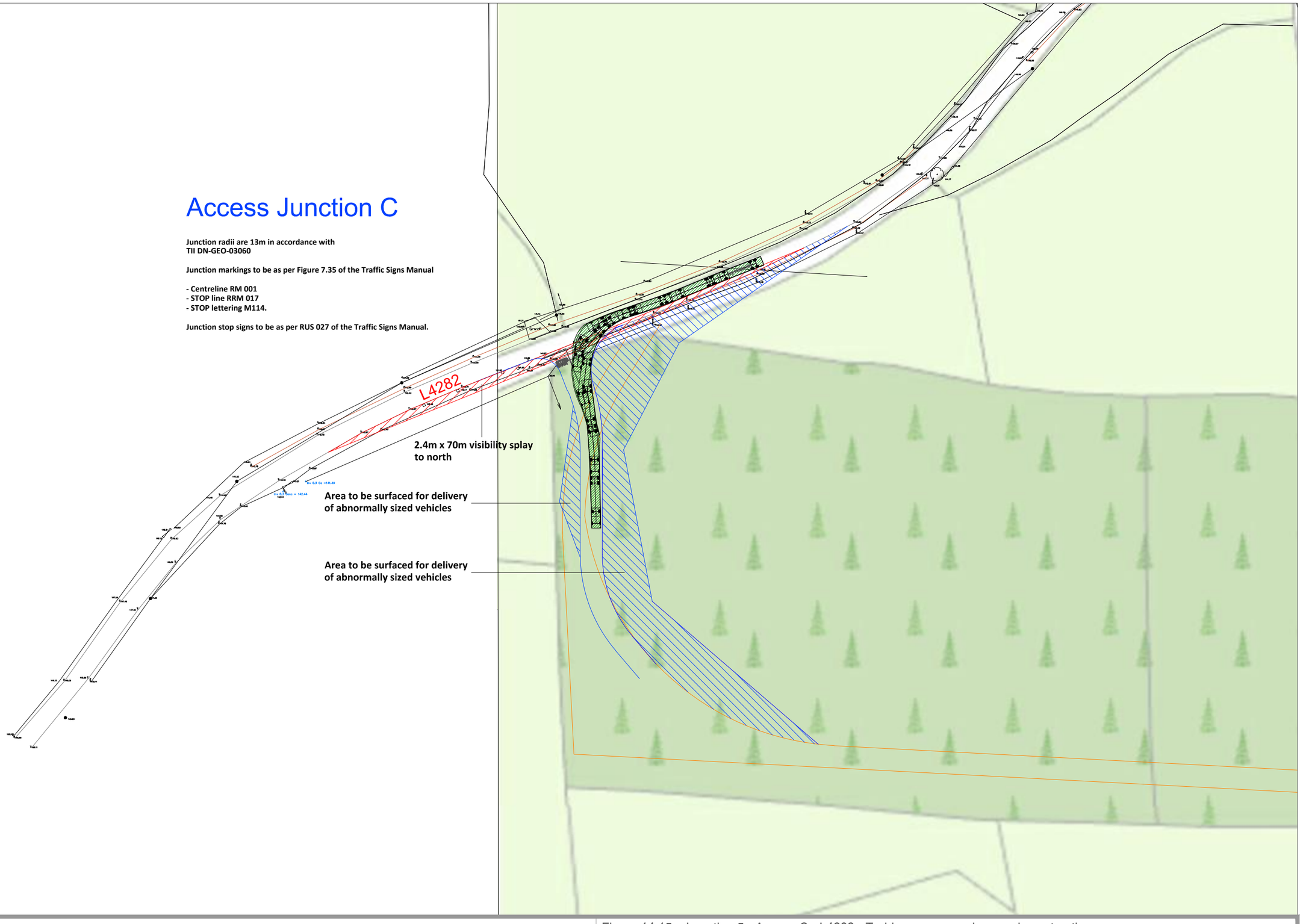
Access Junction C

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.15 Location 5 - Access C - L4282 - Turbine access and general construction access, autotrack assessment for large standard artic HGVs

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

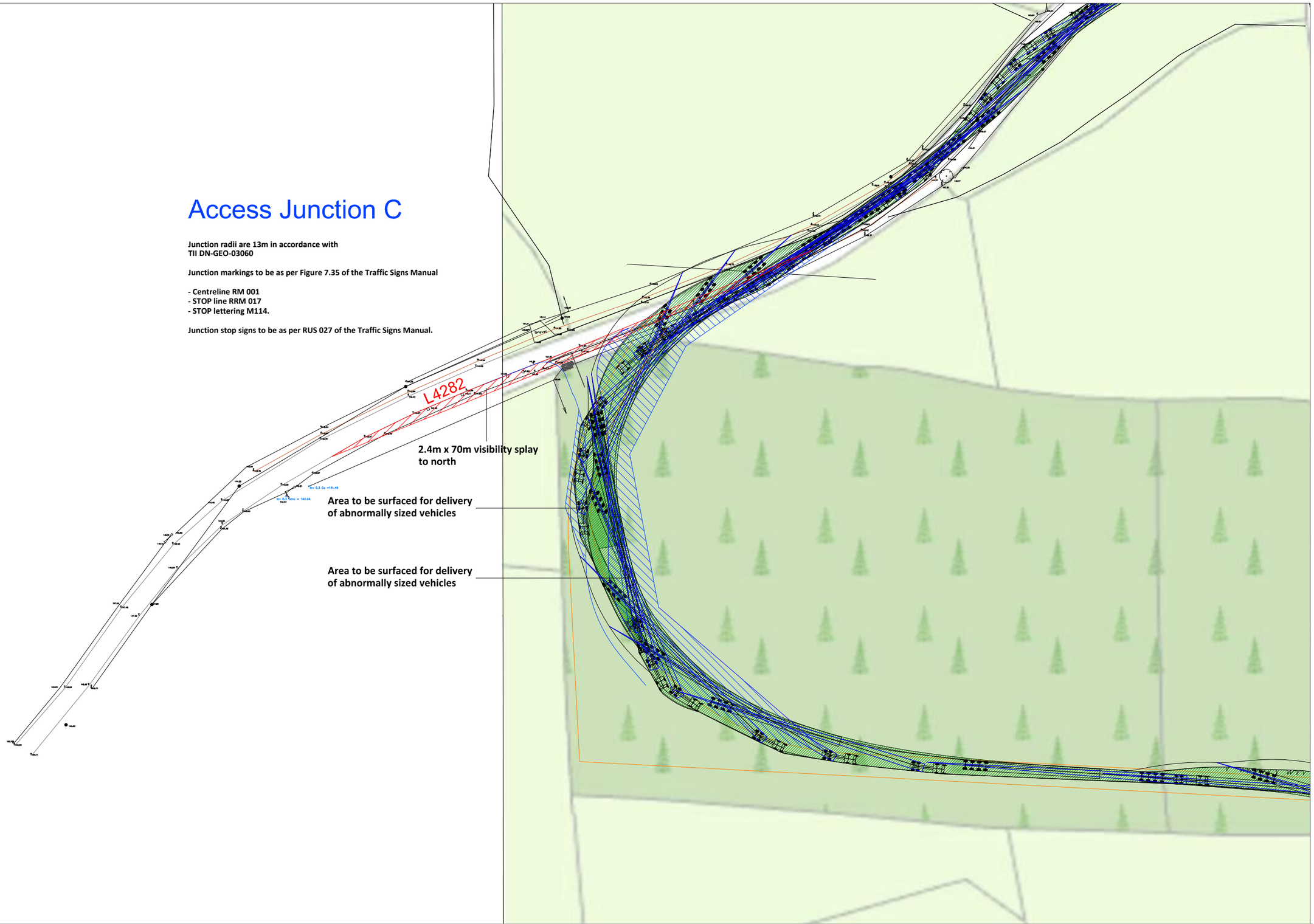
Access Junction C

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.16 Location 5 - Access C - L4282 - Turbine access and general construction access, autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

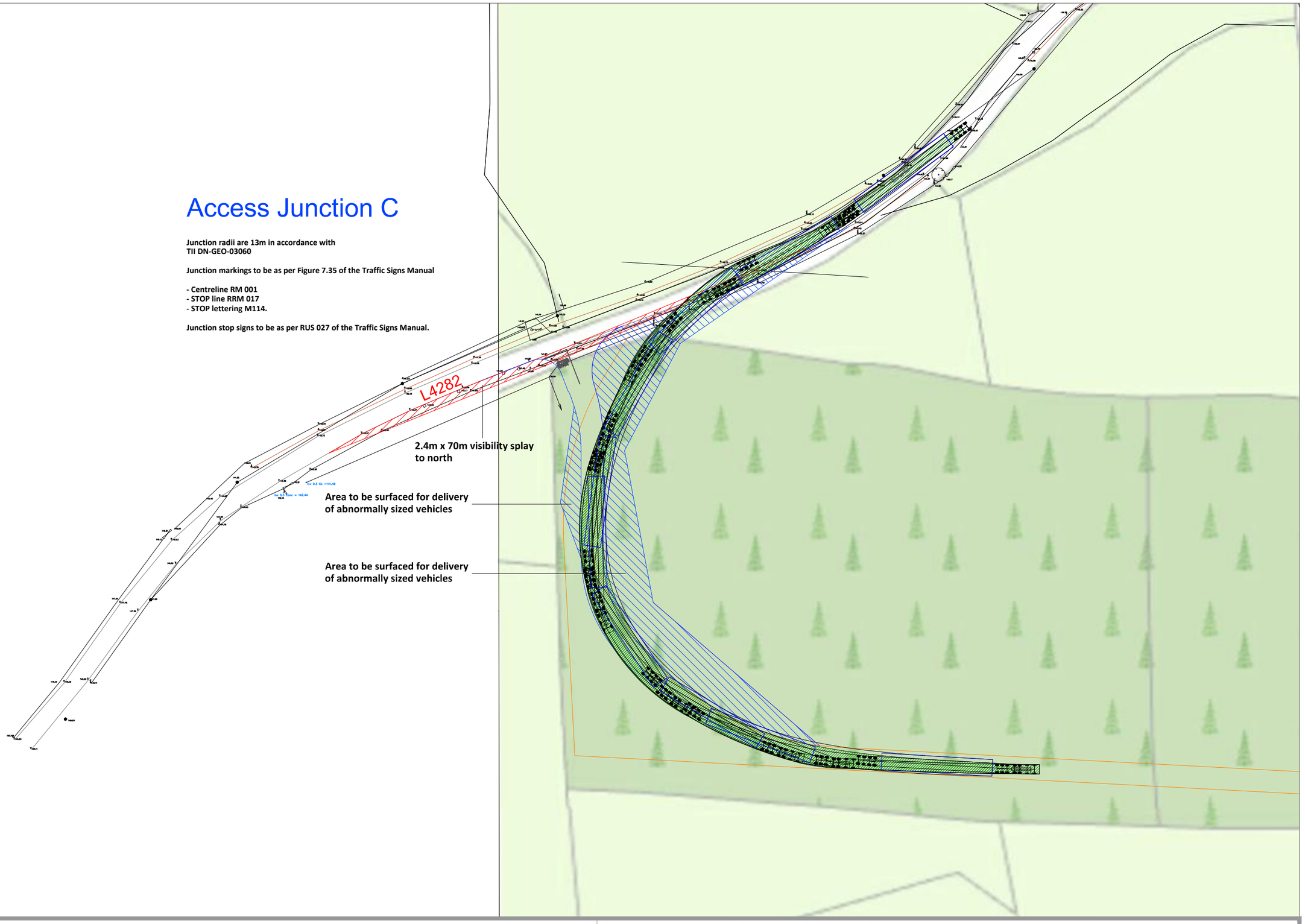
Access Junction C

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.17 Location 5 - Access C - L4282 - Turbine access and general construction access, autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.18 Location 6 - Access D - L4282 - Turbine access and general construction access, proposed layout and visibility splay

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.19 Location 6 - Access D - L4282 - Turbine access and general construction access, autotrack assessment for large standard artic HGVs

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Access Junction D

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.20 Location 6 - Access Junction D - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte		SCALE: 1:1000
PROJECT NO: 7410	DATE: 26.06.20		DRAWN BY: AL

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TRAFFIC & TRANSPORT CONSULTANTS

Access Junction D

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.21 Location 6 - Access Junction D - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte		SCALE: 1:1000
PROJECT NO: 7410	DATE: 26.02.20		DRAWN BY: AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.22 Location 7 - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.23 Location 7 - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.24 Location 8 - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.25 Location 8 - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

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587716, 821

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.26 Location 9 - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.27 Location 9 - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.28 Location 10 - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.29 Location 10 - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte		SCALE: 1:1000
PROJECT NO: 7410	DATE: 26.06.20		DRAWN BY: AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.30 Location 11 - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

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NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.31 Location 11 - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim				
CLIENT:	Coillte			SCALE:	1:1000
PROJECT NO:	7410	DATE:	26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.32 Location 12 - L4282 - autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

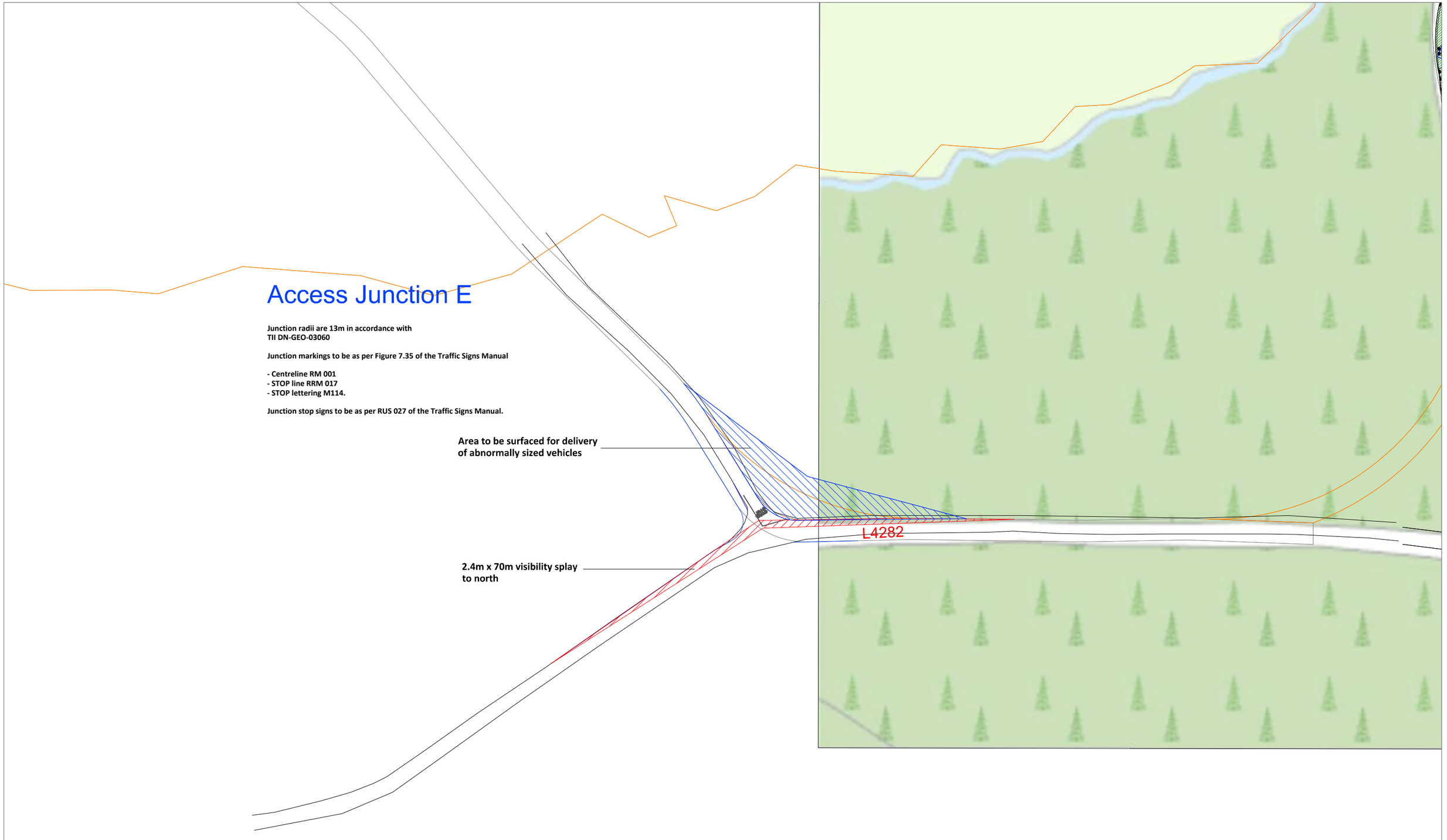
PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.33 Location 12 - L4282 - autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte		SCALE: 1:1000
PROJECT NO: 7410	DATE: 26.06.20		DRAWN BY: AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.34 Location 13 - Access E - L4282 - Turbine access and general construction access, proposed layout and visibility splays

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 03.07.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Access Junction E

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

Area to be surfaced for delivery of abnormally sized vehicles

2.4m x 70m visibility splay to north

L4282

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.35 Location 13 - Access E - L4282 - Turbine access and general construction access, autotrack assessment for large standard artic HGVs

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 03.07.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Access Junction E

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

Area to be surfaced for delivery of abnormally sized vehicles

2.4m x 70m visibility splay to north

L4282

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.36 Location 13 - Access E - L4282 - Turbine access and general construction access, autotrack assessment for blade extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 03.07.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Access Junction E

Junction radii are 13m in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.

Area to be surfaced for delivery of abnormally sized vehicles

2.4m x 70m visibility splay to north



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.37 Location 13 - Access E - L4282 - Turbine access and general construction access, autotrack assessment for tower extended artic

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	1:1000
PROJECT NO: 7410	DATE: 03.07.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

1.1 Outline Construction Traffic Management Plan

1.1.1 Introduction

This outline Traffic Management Plan (outline TMP) will be a key construction contract document, the implementation of which will reduce possible impacts which may occur during the construction of the proposed development. In the event planning permission is granted for the proposed development, the final TMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned.

The Project Supervisor Construction Stage when appointed, along with the turbine supplier will also review and update of the Traffic Management Plan.

1.1.2 Construction Phases

The construction phase of the proposed development will run for between 12 - 18 months. Due to the size of the site, its general layout and the total number of turbines proposed, it is unlikely that the construction phase will require phasing. Therefore, the following sequence of construction activities are proposed:

- Construction of main road access and site entrances, including the proposed link road and site access road, as described in Chater 4 of the EIAR.
- Initial installation of on-site tracks and drainage.
- Installation of new access tracks and upgrade of existing.
- Development of the construction compound and any other temporary works.
- Construction of substation and control building.
- Preparation of crane hard standings.
- Construction of turbine foundations.
- Installation of internal site cabling within wind farm
- Installation of the grid connection cabling
- Wind Turbine erection
- Land reinstatement.

1.1.2.1 Site Access Tracks

The internal access tracks will provide the required access to all turbines and associated infrastructure. The new and proposed upgraded access tracks have been designed to provide a minimum 5 meter running width along the straight sections of track with wider sections proposed at bends where required. Passing bays will be installed to allow a mechanism for two-way traffic. Appropriate signage at the location of these passing bays as well as instruction on priority vehicles will be installed throughout the site. The running surface on the existing and proposed new access tracks will facilitate the delivery of abnormally sized loads.

Where upgrades of or adjacent to existing public road junctions as well as the provision of the construction access ,road for turbine deliveries and other construction materials are to be completed, as outlined in Chapter 4 of the EIAR, the traffic management on the public road at these locations will be provided by the appointed contractor with the approval of the appropriate roads authority.

1.1.2.2 Access to the Site from the Public Road Network

The site will be accessed via a forestry track off the L4282 leading to the site, in the townland of Boleymaguire. It is proposed to upgrade the existing forestry track for use as the site entrance during the construction and operational phases.
The delivery of all abnormally sized loads to the site will be via the R280 from the south to Drumkeeran, followed by the proposed link road between the R280 and the L4282, followed by sections of the L4282 and the proposed construction access road to the site access. Delivery of general construction traffic

will travel to Drumkeeran from either the south or the north and continue onto the site via the L4282 and the proposed construction access road. From here, the vehicles will use the internal site roads to access the proposed infrastructure locations within the site. The entrance to the proposed development site will be secured at the end of each working day with a gate.

The public roads on the turbine haul route as well as all other potential materials delivery routes will be subject to a confirmatory, condition survey prior to the commencement of any works at the proposed development site. This will include a structural integrity survey at all bridges and culverts which will be traversed by the grid connection cabling as well as the turbine delivery route.

1.1.2.3 Turbine Components Delivery

The deliveries of turbine components to the site will be made in convoys of approximately three to five vehicles at a time, and mostly at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a transient "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

It is not anticipated that any section of the local road network will be closed during transport of turbines, although there will be some delays to local traffic at pinch points. During these periods it may be necessary to operate local diversions for through traffic. All deliveries comprising abnormally large loads will be made outside the normal peak traffic periods to avoid disruption to work and school-related traffic.

Prior to the Outline Traffic Management Plan being finalised, a full dry run of the transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the final traffic management plan. All turbine deliveries will be provided for in a transport management plan which will have to be prepared in advance of the construction stage, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a transport management plan is typically submitted to the Planning Authority for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls. The proposed turbine delivery route is shown in Figure 14.1 of the EIAR.

The delivery of the abnormally sized turbine components will be carried by a specialist haulage company who will complete a confirmatory trial run prior to delivery.

It will be the responsibility of the appointed haulage company to liaise with the relevant local authorities and An Garda Siochána to secure the necessary permits. A system of public notification will also be required to provide residents with the intended delivery schedule of these abnormal loads. This information will be passed on by a leaflet drop, local engagement and/or the provision of the project website with updated notifications if deemed necessary at the time. This will form part of the continued community engagement effort as set out in Appendix 2-2 of the EIAR.

1.1.2.4 Grid Connection Consents

The proposed grid connection route will require a Road Opening License (ROL) prior to the commencement of any grid connection works on the public road.

1.1.3 Traffic Management Plan

A final Traffic Management Plan (TMP), incorporating all the mitigation measures set out in this Outline TMP, will be prepared by the appointed contractor which will detail in respect of traffic management agreed with the roads authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following:

Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.

Delivery Programme – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site.

Information to locals – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (if required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Contract Project Co-ordinator, who will be the main point of contact for all queries from the public or local authorities during normal working hours. An "out of hours" emergency number will also be provided.

A Pre and Post Construction Condition Survey – A pre-condition survey of roads associated with the proposed development will be carried out prior to construction commencement to verify and record the condition of the road. A post construction survey will be carried out after works are completed. Where required the timing of these surveys will be agreed with the local authority.

Liaison with the relevant local authority - Liaison with the County Councils and An Garda Síochána, will be carried out during the delivery phase of the abnormally sized turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, the Roads section will be informed of the relevant names and contact numbers for the Project Developer/Contractor Site Manager as well as the Site Environmental Manager.

Implementation of temporary alterations to road network at critical locations – At locations highlighted in Section 14.1.8. of the EIAR. This includes the construction of the proposed link road between the R280 and the L4282, the proposed construction access road to re-route construction traffic off a section of the L4282, and local road widening at various locations on the L4282. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable.

Identification of delivery routes – These routes are identified in Section 4.4 of Chapter 4 of the EIAR and will be adhered to by all contractors.

Travel plan for construction workers – While the assessment set out in the EIAR assumes the worst case that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff.

Temporary traffic signs – As part of the traffic management measures temporary traffic signs will be put in place at all key junctions, including all new junctions providing access to the site off the R280. All measures will be in accordance with the *"Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works"* (Department of Transport, Tourism and Sport (DoTT&S)) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery times.

Delivery times of large turbine components - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.

Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required.

Re-instatement works - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Road Opening Licence – Roads works associated with the grid connection cabling will be undertaken in line with the requirements of a road opening licence as agreed with Leitrim County Council.

Diversions and road closures – reasonable access to residences, farms and businesses will be maintained at all times during any road closures associated with the cable works. The details of this will be agreed with the roads authority in advance of works taking place. The network of local roads in the area will be used for traffic diversions for local traffic in order to expedite the works and limit the duration of the impact owing to the cabling works.

Trench Reinstatement - Trenches on public roads, once backfilled, will be temporarily reinstated to the satisfaction of the roads authority. Following temporary reinstatement of trenches sections of public roads along which the cable route travels will receive a surface overlay subject to agreement with the roads authority.