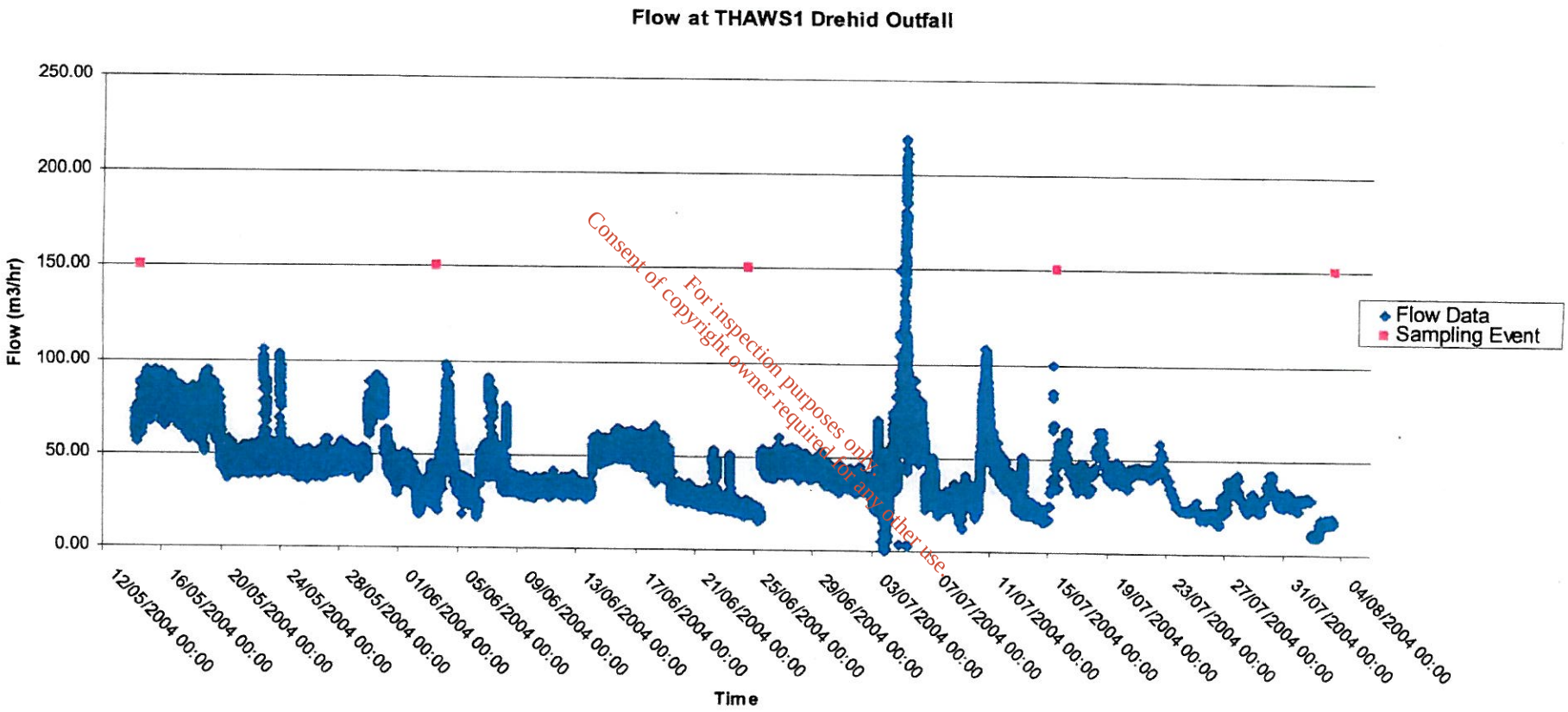
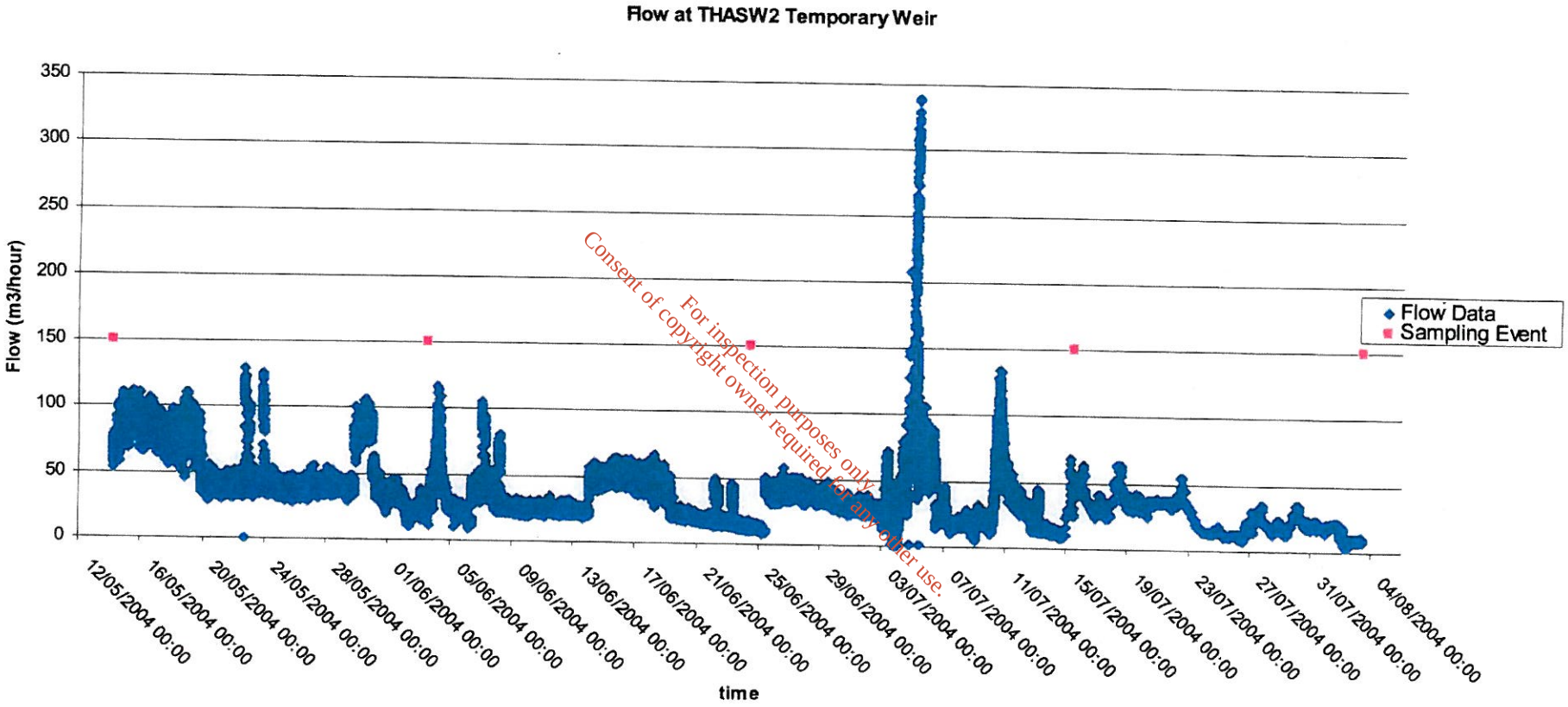
APPENDIX 2.5.3
Hydrometric Station Hydrographs





APPENDIX 2.5.4
Sedimentation Lagoon Trends 2007

Sedimentation Lagoon Data 2007

	SL pH (pH units)		Conductivity (µS/cm)		Dissolved Oxygen (mg/L)		Suspended Solids (mg/L)		Orthophosphates
Week 1	7.6	Week 1	398	Week 1	12.56	Week 1	9	Week 7	<0.02
Week 3	7.7	Week 3	375	Week 3	10.26	Week 3	34	Week 8	<0.02
Week 4	7.9	Week 4	407	Week 4	12.22	Week 4	78	Week 9	<0.02
Week 5	7.6	Week 5	348	Week 5	13.87	Week 5	53	Week 10	<0.02
Week 6	7.7	Week 6	408	Week 6	10.21	Week 6	<5	Week 11	<0.02
Week 7	8.1	Week 7	373	Week 7	11.13	Week 7	146	Week 12	<0.02
Week 8	7.8	Week 8	391	Week 8	12.33	Week 8	<5	Week 13	<0.02
Week 9	7.8	Week 9	398	Week 9	14.02	Week 9	8	Week 14	<0.02
Week 10	7.9	Week 10	297	Week 10	9.65	Week 10	<5	Week 15	<0.02
Week 11	8	Week 11	311	Week 11	11.62	Week 11		Week 16	<0.02
Week 12	8.1	Week 12	302	Week 12	10.12	Week 12	7	Week 17	<0.02
Week 13	7.8	Week 13	541	Week 13	11.54	Week 13	23	Week 18	0.02
Week 14	7.6	Week 14	591	Week 14	10.46	Week 14	21	Week 19	<0.02
Week15	7.6	Week 15	601	Week 15	10.11	Week 15	50	Week 20	<0.02
Week 16	8	Week 16	577	Week 16	13.21	Week 16	5	Week 21	<0.02
Week 17	7.9	Week 17	425	Week 17	10.69	Week 17	8	Week 22	<0.02
Week 18	8.2	Week 18	705	Week 18	12.07	Week 18	10	Week 23	<0.01
Week 19	8.2	Week 19	701	Week 19	11.87	Week 19	<5	Week 24	<0.01
Week 20	7.9	Week 20	655	Week 20	9.32	Week 20	11	Week 25	<0.01
Week 21	7.9	Week 21	567	Week 21	8.12	Week 21	11	Week 26	<0.01
Week 22	8	Week 22	826	Week 22	9.63	Week 22	11	Week 27	<0.01
Week 23	8.3	Week 23	596	Week 23	7.96	Week 23	7	Week 28	<0.01
Week 24	8.4	Week 24	614	Week 24	8.01	Week 24	5	Week 29	<0.01
Week 25	8.1	Week 25	177	Week 25	7.55	Week 25	6	Week 30	<0.01
Week 26	8.2	Week 26	575	Week 26	8.22	Week 26	8	Week 31	<0.01
Week 27	8	Week 27	602	Week 27	8.63	Week 27	13	Week 32	
Week 28	7.9	Week 28	614	Week 28	8.15	Week 28	6	Week 33	<0.01
Week 29	7.5	Week 29	624	Week 29	9.01	Week 29	7	Week 34	<0.01
Week 30	7.3	Week 30	464	Week 30	10.1	Week 30	<5	Week 35	<0.01
Week 31	7.5	Week 31	542	Week 31	10.08	Week 31	<5	Week 36	<0.01
Week 32	7.4	Week 32	700	Week 32	5.4	Week 32	8	Week 37	<0.01
Week 33	7.4	Week 33	485	Week 33	6.4	Week 33	<5	Week 38	<0.01
Week 34	7.4	Week 34	506	Week 34	7.53	Week 34	11	Week 39	0.02
Week 35	7.5	Week 35	526	Week 35	5.95	Week 35	8	Week 40	0.02
Week 36	7.7	Week 36	561	Week 36		Week 36	9	Week 41	0.03
Week 37	7.6	Week 37	741	Week 37	6.62	Week 37	8	Week 42	
Week 38	7.6	Week 38	526	Week 38	7.4	Week 38	8	Week 43	0.02
Week 39	7.7	Week 39	583	Week 39	7.05	Week 39	7	Week 44	0.06
Week 40	7.7	Week 40	526	Week 40	7.4	Week 40	8	Week 45	0.02
Week 41	7.7	Week 41	773	Week 41	6.4	Week 41	<5	Week 46	0.02
Week 42		Week 42		Week 42		Week 42		Week 47	0.02
Week 43	7.7	Week 43	585	Week 43		Week 43	<5	Week 48	0.02
Week 44	7.7	Week 44	702	Week 44		Week 44	<5	Week 49	0.03
Week 45	7.5	Week 45	573	Week 45		Week 45	<5	Week 50	
Week 46	7.7	Week 46	594	Week 46		Week 46	12		
Week 47	7.6	Week 47	568	Week 47	6.48	Week 47	12		
Week 48	7.6	Week 48	573	Week 48	7.5	Week 48	14		
Week 49	7.5	Week 49	495	Week 49	7.59	Week 49	18		

Dillon's Bridge

	Suspended Solids (mg/L)		Ammonia as NH3-N (mg/L)		Chloride (mg/L)		Orthophosphates
Week 1		Week 1	0.58	Week 1	14	Week 7	0.02
Week 3		Week 3	0.28	Week 3	13	Week 8	<0.02
Week 4		Week 4	0.23	Week 4	14	Week 9	0.03
Week 5		Week 5	0.34	Week 5	14	Week 10	0.04
Week 6		Week 6	0.61	Week 6	13	Week 11	0.03
Week 7	15	Week 7	0.37	Week 7	14	Week 12	0.62
Week 8	12	Week 8	0.46	Week 8	14	Week 13	<0.02
Week 9	25	Week 9	0.44	Week 9	14	Week 14	<0.02
Week 10	18	Week 10	0.04	Week 10	14	Week 15	<0.02
Week 11	17	Week 11	0.03	Week 11	13	Week 16	0.03
Week 12	14	Week 12	0.16	Week 12	14	Week 17	<0.02
Week 13	24	Week 13	0.16	Week 13	14	Week 18	0.11
Week 14	20	Week 14	0.23	Week 14	14	Week 19	<0.02
Week 15	32	Week 15	0.52	Week 15	15	Week 20	<0.02
Week 16	16	Week 16	0.6	Week 16	14	Week 21	<0.02
Week 17	7	Week 17	0.45	Week 17	14	Week 22	<0.02
Week 18	5	Week 18	<0.02	Week 18	16	Week 23	<0.01
Week 19	<5	Week 19	0.24	Week 19	16	Week 24	0.03
Week 20	7	Week 20	0.28	Week 20	14	Week 25	0.02
Week 21	11	Week 21	0.17	Week 21	15	Week 26	0.02
Week 22	6	Week 22	0.42	Week 22	15	Week 27	<0.01
Week 23	<5	Week 23	0.21	Week 23	14	Week 28	0.04
Week 24	8	Week 24	0.12	Week 24	15	Week 29	0.02
Week 25	<5	Week 25	0.1	Week 25	13	Week 30	<0.01
Week 26	<5	Week 26	0.09	Week 26	13	Week 31	<0.01
Week 27	7	Week 27	0.86	Week 27	14	Week 32	
Week 28	<5	Week 28	0.05	Week 28	13	Week 33	0.03
Week 29	<5	Week 29	0.13	Week 29	13	Week 34	0.06
Week 30	<5	Week 30	0.25	Week 30	17	Week 35	0.02
Week 31	<5	Week 31	0.25	Week 31	12	Week 36	0.02
Week 32	6	Week 32	0.15	Week 32	12	Week 37	0.02
Week 33	8	Week 33	0.16	Week 33	12	Week 38	0.03
Week 34	9	Week 34	0.24	Week 34	12	Week 39	0.03
Week 35	6	Week 35	0.22	Week 35	12	Week 40	0.02
Week 36	5	Week 36	0.2	Week 36	12	Week 41	0.03
Week 37	8	Week 37	0.1	Week 37	12	Week 42	
Week 38	<5	Week 38	0.08	Week 38	12	Week 43	0.01
Week 39	<5	Week 39	0.17	Week 39	13	Week 44	0.03
Week 40	12	Week 40	0.23	Week 40	12	Week 45	0.03
Week 41	5	Week 41	0.17	Week 41	20	Week 46	0.02
Week 42		Week 42		Week 42		Week 47	0.03
Week 43	8	Week 43	0.32	Week 43	15	Week 48	0.03
Week 44	11	Week 44	0.22	Week 44	12	Week 49	0.03
Week 45	<5	Week 45	0.89	Week 45	12	Week 50	
Week 46	9	Week 46	0.22	Week 46	16		
Week 47	7	Week 47	0.22	Week 47	13		
Week 48	14	Week 48	0.43	Week 48	13		
Week 49	16	Week 49	0.5	Week 49	13		

APPENDIX 2.5.5
1:50 year Rainfall runoff calculation

TOBIN
Patrick J. Tobin & Co. Ltd.

CALCULATION SHEET	ref. no. 3369
project. Drehid WMF	sheet no. 6
element. Surface Water Attenuation	date. 01/02/08

Storm Return Period =	50	Years		
Total Site Area =	40.2	Hectares (ha)		
Existing Open Space =	40.2	ha		
Proposed Impermeable Area				
Roof Area =	0.40	ha	.....@	100%
Hard Standing /Road Area =	0.40	ha	.....@	100%
Open Area =	39.400	ha	.....@	100%
Allowable Outflow =	8.3	Litres/sec/ha		

Rainfall Intensity, Lullymore, Co. Kildare.

Duration (min)	Rainfall (mm)	Intensity (mm/hr)	Rainfall (m^3/ha)	Proposed Runoff (m^3)	Lake Area Flow (m^3)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Req'd (m^3)
2	5.4	162.00	54	2160	0	2160	40	2120
5	9.8	117.60	98	3920	0	3920	100	3820
10	14.5	87.00	145	5800	0	5800	199	5601
15	18.6	74.40	186	7440	0	7440	299	7141
30	24.0	48.00	240	9600	0	9600	598	9002
60	29	29.00	290	11600	0	11600	1195	10405
120	35	17.50	350	14000	0	14000	2390	11610
240	42	10.50	420	16800	0	16800	4781	12019
360	48	8.00	480	19200	0	19200	7171	12029
720	59	4.92	590	23600	0	23600	14342	9258
1440	69	2.88	690	27600	0	27600	28685	1065
2880	81	1.69	810	32400	0	32400	57370	-24970

Maximum value of storage required = **12029** m^3

APPENDIX 2.5.6
Sedimentation Lagoon Design Efficiency

Drehid WMF	**Job ref.** 3369
Part of Structure Surface Water Lagoons	
	Date Feb-08

Storage Required for 1 in 50 yr storm with allowable outflow of 8.3 l/s/ha =12,100m^3 see attached sheet

Storage in Pond:

Total Storage in Lagoon:

83.9 - 81.15=	2.75	m
83.9 - 80.0=	3.9	m
Average Depth =	3.325	
Volume= 4(3.325*120*15)=	23940	m^3

Retained Level:

82.75-81.15=	1.6	m
82.75-80.0=	2.75	m
Average Depth =	2.175	m
Volume= 4*(2.175*120*15)=	15660	m^3

Net Storage in Lagoon

=Total Storage - Retained Storage

= 8280 m^3

Storage required 12100 rounded up

Storage in Swale:

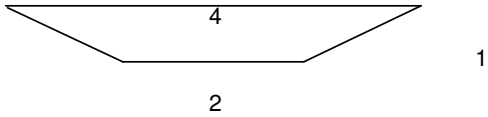
Storage Required = Total storage Required - Net storage in pond

= 3820 m^3

Storage in swale @ 3690m length and 0.5 metre depth 4613 m^3

Excess capacity in swale @ 0.5m deep 793 m^3

Swale Dimensions;



@ 1m deep=3m^2

@ 0.5m deep=1.25m^2

So required storage provided in swale at less than 0.5m depth

Contract	Job ref.
Drehid WMF	3369
	Date Feb-08

From Ciria Publication "Design of Flood Storage Resevoirs" 6.5.3 the trap efficiency can be calculated

n=	$V_s t_R/d_l$	where,	d_l =	Flowing Layer Depth	
			t_R=	Residence Time	
			V_s=	Settling Velocity	From T6.6 CIRIA
			n =	Trap Efficiency	

From before;	V=	14400	m^3
	t_R=	43373.49	sec

Mean Flow through V= L/t_R L= Length of pond = 120m

= 0.002767 m/s

Check Efficiency:

@ Normal Waterleve $n=V_s t_R/d_l$

Course silt 0.06mm	n =	36.96232	or	settled out within 1/36th of length
Fine Silt 0.01mm	n =	1.026731	or	103 % efficency
Clay 0.005mm	n =	0.256683	or	26 % efficency

APPENDIX 2.7.1
Criteria for Assessing Site Evaluation

Appendix 2.7.1 Criteria for assessing Site Evaluation

Rating	Qualifying Criteria
A	**Internationally important** • Sites designated (or qualifying for designation) as SAC* or SPA* under the EU Habitats or Birds Directives. • Undesignated sites containing good examples of Annex I priority habitats under the EU Habitats Directive. • Major salmon river fisheries. • Major salmonid (salmon, trout or char) lake fisheries
B	**Nationally Important** • Sites or waters designated or proposed as an NHA* or statutory Nature Reserves. • Undesignated sites containing good examples of Annex I habitats (under EU Habitats Directive). • Undesignated sites containing significant numbers of resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive or species protected under the Wildlife (Amendment) Act 2000. • Major trout river fisheries. • Water bodies with major amenity fishery value. • Commercially important coarse fisheries.
C	**High value, locally important** • Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or significant populations of locally rare species. • Small water bodies with known salmonid populations or with good potential salmonid habitat. • Sites containing any resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive. • Large water bodies with some coarse fisheries value
D	**Moderate value, locally important** • Sites containing some semi-natural habitat or locally important for wildlife. • Small water bodies with some coarse fisheries value or some potential salmonid habitat. • Any water body with unpolluted water (Q-value rating 4-5).
E	**Low value, locally important** • Artificial or highly modified habitats with low species diversity and low wildlife value. • Water bodies with no current fisheries value and no significant potential fisheries value.

*SAC = Special Area of Conservation
SPA = Special Protection Area
NHA = Natural Heritage Area

APPENDIX 2.7.2
Nature Conservation Designated Site Synopses

Appendix 2.7.2. Nature Conservation Designated Site Synopses

SITE NAME: BALLINA BOG

SITE CODE: 000390

Ballina Bog is situated about 8 km west of Enfield and just south-west of Moyvally in an elongated valley.

Much of the surface is of good quality and quite wet in spite of the presence of many drains. The drains cross the bog in an NE-SW direction and also a few run E-W. The former are shallow and of long standing. Many have been filled in by *Sphagnum* growth but retain moving water towards the edges of the bog. Two much deeper drains were inserted in the early 1980s and may cause more long-term damage to the bog.

The vegetation and structure of the surface is well developed, especially in the southern half. Substantial areas of hummock and hollow topography exists, with pools and active *Sphagnum* growth. Much of the *Sphagnum* is *S. magellanicum*. Heather (*Calluna vulgaris*) and Cottongrass (*Eriophorum vaginatum* and *E. angustifolium*) are frequent on the surface. A large part of the bog has remained unburnt for 20-30 years and contains an abundance of the lichen *Cladonia impexa*.

Marginal peat cutting has been carried out at the northern and eastern ends of the bog.

Despite the presence of many drains, the condition of the vegetation and surface makes this bog of considerable scientific importance. It is one of the most easterly raised bogs which is relatively intact.

SITE NAME : BALLYNAFAGH BOG

SITE CODE : 000391

This site is a raised bog situated about 1 km west of Prosperous in County Kildare. The area is directly underlain by muddy, fossiliferous limestones, interbedded with calcareous shales. The subsoils are predominantly clay-rich tills. All are of low permeability.

An estimated 46% of the site consists of intact raised bog habitat. In the wettest area towards the centre, a system of tear pools occurs, grown over with Bog Mosses (*Sphagnum capillifolium* and *S. magellanicum*). There is a small pool-and-hummock system, with pools colonised by another species of Bog Moss (*Sphagnum cuspidatum*). White Beak-sedge

(*Rhynchospora alba*), Cottongrasses (*Eriophorum* spp.) and the insectivorous Great Sundew (*Drosera anglica*) are abundant in wet channels. Bog Rosemary (*Andromeda polifolia*) and Cranberry (*Vaccinium oxycoccos*) are found on the hummocks.

A large portion of the site contains old cutaway bog colonised by Rushes (*Juncus* spp.) and Common Cottongrass (*Eriophorum angustifolium*), with Downy Birch (*Betula pubescens*) forming patches of scrub/woodland.

The site is within the territory of a breeding pair of Merlin, a species listed on Annex I of the EU Birds Directive. Several pairs of Curlew and Snipe breed on the bog. Scrub species such as Stonechat, Redpoll and Long-tailed Tit occur on the cutaway.

The bog has been damaged by afforestation, mechanised peat-cutting and drainage. These three activities pose the main threats to the survival of raised bogs.

Raised bogs are a rare habitat in Europe, and in Ireland continue to be under threat. Ballynafagh Bog, although damaged, is of added interest as the most easterly site with a high proportion of intact raised bog habitat remaining in Ireland.

SITE NAME: BALLYNAFAGH LAKE

SITE CODE: 001387

Ballynafagh Lake is located about 2 km north-west of Prosperous in Co. Kildare. It is a shallow alkaline lake with patches of emergent vegetation in the middle as well as around the shore. Submerged plants include Starwort (*Callitriche* spp.) and Bladderwort (*Utricularia minor*), with Duckweed (*Lemna minor*) and the liverwort *Riccocarpus natans* occurring on the surface.

Alkaline fen vegetation occurs at the lake edge, notably a plant community dominated by Blunt-flowered Rush (*Juncus subnodulosus*) and Black-bog Rush (*Schoenus nigricans*), with frequent Sedges (*Carex lepidocarpa, C. rostrata*). Other species in this area include Marsh Marigold (*Caltha palustris*), Red Rattle (*Pedicularis palustris*), Arrow Grass (*Triglochin palustre*), Water Mint (*Mentha aquatica*) and Bulrush (*Typha latifolia*). Extensive stands of Reed (*Phragmites australis*), Bulrush and Bottle Sedge (*Carex rostrata*) occur around the open water. A stand of Great Fen-sedge (*Cladium mariscus*) occurs in the western corner.

The lake is surrounded by acid grassland, heath and bog. Here the vegetation includes Bent Grass (*Agrostis tenuis*), Purple Moor-grass (*Molinia caerulea*), Bog Myrtle (*Myrica gale*), Bracken (*Pteridium aquilinum*), Gorse (*Ulex europaeus*) and Heather (*Calluna vulgaris*). Wet woodland of Birch (*Betula* spp.), Willow (*Salix* spp.) and Alder (*Alnus* spp.) occurs in the north-west corner of the lake.

The Blackwood Feeder connects Ballynafagh Lake to the Grand Canal and is of particular conservation significance for the populations of two rare snail species, *Vertigo moulinsiana* and *Pisidium pseudosphaerium*, that it supports. The former species is listed on Annex II of the E.U. Habitats Directive, while the latter has previously been recorded only from sites along the Royal Canal. *Vertigo moulinsiana* also occurs in wetland vegetation by Ballynafagh Lake itself. A high diversity of molluscan species is found on the site (42 species recorded in 1997).

Breeding birds of the lake include Little Grebe, Mallard, Moorhen, Coot, Snipe and Water Rail. In May 1993 a pair of Curlew was observed holding territory. Sedge Warbler, Reed Bunting and Whitethroat breed within the site. Black-headed Gulls formerly bred at the lake but only single birds were observed in 1993. Wintering waterfowl include: Whooper Swan 20, Teal 114, Mallard 110, Golden Plover 40 and Curlew 117 (all counts average peaks, 1 season 1984/85 - 86/87). The main landuse of the lake is fishing. There is a No Shooting Area Order on the site.

Although originally a reservoir, Ballynafagh lake has developed a very natural vegetation with some interesting plant communities, including alkaline fen, a habitat that is listed on Annex I of the E.U. Habitats Directive. The site supports a high diversity of molluscan species, with some rare species recorded, including *Vertigo moulinsiana*, a species that is listed on Annex II of the E.U. Habitats Directive. The site is also of ornithological importance.

SITE NAME: CARBURY BOG

SITE CODE: 001388

This site is situated just north of the village of Carbury and Carbury Hill, which rises to 470 ft.

The bog lies in a depression elongated on a NW-SE axis. The northern part of the bog has been cut or has been drained in preparation for future exploitation. The surface of the remainder has bog vegetation but is rather dry and shows little variation. The SE limb is neatly cut off by the Carbury Broadford road.

This site is of interest as it is a remnant of a raised bog, still showing some characteristics of raised bog vegetation. Similar habitats are now very scarce in Co Kildare

SITE NAME: DONADEA WOOD

SITE CODE: 001391

This site is located about 6 km north of Prosperous. It is the old demesne woodland of Donadea Castle, and now owned by Coillte. The soil of the area is glacial drift.

The entire site has been planted with a mix of deciduous and coniferous trees. Ash (*Fraxinus excelsior*) is the predominant deciduous species, with some Cherry (*Prunus* spp.), Oak (*Quercus* spp.), Beech (*Fagus sylvatica*) and Sycamore (*Acer pseudoplatanus*). Occasional patches of Elder (*Sambucus nigra*), Hazel (*Corylus avellana*) and Hawthorn (*Crataegus monogyna*) are found.

The ground flora is poorly developed and species poor. Some of the species which have been recorded are Lords-and-ladies (*Arum maculatum*), Primrose (*Primula vulgaris*), Violet (*Viola riviniana*), Yellow Pimpernel (*Lysimachia nemorum*), Ground Ivy (*Glechoma hederacea*), Wood Avens (*Geum urbanum*) and Wood Sage (*Carex sylvatica*).

The site is notable for the presence of two rare species of Myxomycete fungus, namely *Diderma chondrioderma* and *Licea testudinacea*, the latter in one of only two known Irish sites.

This site is of scientific interest as, although highly managed, it has a significant proportion of deciduous trees and parts of the site have been wooded for a long period.

SITE NAME: GRAND CANAL

SITE CODE: 002104

The Grand Canal is a man-made waterway linking the River Liffey at Dublin with the Shannon at Shannon Harbour and the Barrow at Athy. The Grand Canal Natural Heritage Area (NHA) comprises the canal channel and the banks on either side of it. The canal system is made up of a number of branches - the Main Line from Dublin to the Shannon, the Barrow Line from Lowtown to Athy, the Edenderry Branch, the Naas and Corbally Branch and the Milltown Feeder. The Kilbeggan Branch is dry at present, but it is hoped to restore it in the near future. Water is fed into the summit level of the canal at Lowtown from Pollardstown Fen, itself an NHA.

A number of different habitats are found within the canal boundaries - hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland.

The hedgerow, although diverse, is dominated by Hawthorn (*Crataegus monogyna*). On the limestone soils of the midlands Spindle (*Euonymus europaeus*) and Guelder-rose (*Viburnum opulus*) are present.

The vegetation of the towpath is usually dominated by grass species. Where the canal was built through a bog, soil (usually calcareous) was brought in to make the banks. The contrast

between the calcicolous species of the towpath and the calcifuge species of the bog is very striking. The diversity of the water channel is particularly high in the eastern section of the Main Line - between the Summit level at Lowtown and Inchicore. Arrowhead (*Sagittaria sagittifolia*) and Watercress (*Nasturtium officinale*) are more common in this stretch than on the rest of the system. All sites for Hemlock Water-dropwort (*Oenanthe crocata*) on the Grand Canal system are within this stretch.

The aquatic flora of the Corbally Extension of the Naas Branch of the canal is also very diverse, with a similar range of species to the eastern Main Line.

Otter spraints are found along the towpath, particularly where the canal passes over a river or stream.

The Common Newt breeds in the ponds on the bank at Gollierstown in Co. Dublin.

The Rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 1987) is present at a number of sites in the eastern section of the Main Line, between Lowtown and Ringsend Basin in Dublin.

The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. It crosses through agricultural land and therefore provides a refuge for species threatened by modern farming methods.

SITE NAME: THE LONG DERRIES, EDENDERRY

SITE CODE: 000925

The Long Derries is located approximately 5 km south-east of Edenderry and is part of a low esker ridge running from Edenderry to Rathdangan. It primarily consists of glacial gravels interspersed with loam and peat soil.

The dominant habitat is dry calcareous grassland. This can be observed towards the north-western end where Carline Thistle (*Carlina vulgaris*), Marjoram (*Origanum vulgare*), Wild Thyme (*Thymus praecox*) and Cowslip (*Primula veris*) grow. An interesting feature is a number of used and unused gravel pits which are host to plants such as Mountain Everlasting (*Antennaria dioica*) and the rare Fine-leaved Sandwort (*Minuartia hybrida*) among others.

In places invading Hawthorn (*Crataegus monogyna*) forms blocks of scrub interspersed with open areas of calcareous grassland, as can be viewed in the eastern section. The eastern boundary grades into peatland where calcareous runnels are interspersed with miniature peat flushes. Here calcicole plant species are mixed with calcifuge ones such as Heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Lousewort (*Pedicularis sylvatica*) and Devil's-bit Scabious (*Succisa pratensis*).

An important aspect of this site is the presence of the rare, Red Data Book species, Blue Fleabane (*Erigeron acer*), and the legally protected (Flora Protection Order, 1987), Basil Thyme (*Acinos arvensis*) and Green-winged Orchid (*Orchis morio*). A large population of the latter species occurs in the grassland communities, including those in the transition to peatland zone. Blue Fleabane is found in grassland and gravel pits on the site, the latter habitat also supporting Basil Thyme.

The summer birdlife of this area includes Sand Martin, Whinchat, Whitethroat and Cuckcoo. Nightjar, a rare species listed in Annex I of the EU Birds Directive, breeds on the site. Partridge, an endangered species in Ireland and one listed in the Red Data Book, is known from the site. Badgers have setts along some of the mature hedgerows.

The western section of this site is used in connection with activities connected with the harvesting of peat. The eastern section of the site is grazed by cattle and horses. Grazing is essential for the preservation of the rare orchid, but overgrazing needs to be avoided. Shooting and motorbike scrambling are other activities occurring. Although gravel extraction has helped create habitats for some plant species, this could result in excessive damage if uncontrolled. Dumping of rubbish and old railway tracks is undesirable, as is interference with Badger setts.

The Long Derries is of botanical importance due to the presence of good quality dry, calcareous grassland, an interesting gravel pit flora and the presence of three rare plant species, two of which are legally protected. The presence of an interesting transition habitat from Esker to peatland, and a varied bird population, including the rare Nightjar and Partridge, adds to the site's importance.

SITE NAME: ROYAL CANAL

SITE CODE: 002103

The Royal Canal is a man-made waterway linking the River Liffey at Dublin to the River Shannon near Tarmonbarry. There is a branch line from Kilashee to Longford Town. The canal NHA comprises the central channel and the banks on either side of it. The main water supply is from Lough Owel (also an NHA) via a feeder channel into the canal at Mullingar. The Royal Canal was closed to navigation in 1961. The section of canal west of Mullingar was allowed to dry out, and the eastern section silted up and became overgrown. Restoration began in 1988, and is still in progress.

A number of different habitats are found within the canal boundaries - hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland.

The hedgerow, although diverse, is dominated by Hawthorn (*Crataegus monogyna*). On the limestone soils of the midlands Spindle (*Euonymus europaeus*) and Guelder-rose (*Viburnum opulus*) are present.

The vegetation of the towpath is usually dominated by grass species. Crested Dog's-tail (*Cynosurus cristatus*), Quaking Grass (*Briza media*) and Sweet Vernal-grass (*Anthoxanthum odoratum*) are typical species of the calcareous grasslands of the midlands. Where the canal was built through a bog, soil (usually calcareous) was brought in to make the banks. The contrast between the calcicolous species of the towpath and the calcifuge species of the bog is very striking.

Otter spraints are found along the towpath, particularly where the canal passes over a river or stream.

The Rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 1987) is present at one site in Dublin, between Locks 4 and 5. *Tolypella intricata* (a stonewort listed in the Red Data Book as being Vulnerable) is also in the Royal Canal in Dublin, the only site in Ireland where it is now found.

The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. It crosses through agricultural land and therefore provides a refuge for species threatened by modern farming methods.

SITE NAME: HODGESTOWN BOG NHA

SITE CODE: 001393

Hodgestown Bog NHA is located 4 km north-west of Prosperous, mostly in the townlands of Hodgestown, Coolearagh East and Garvoge in Co. Kildare. The site comprises a raised bog that includes both areas of high bog and cutover bog.

This raised bog was originally part of a much larger area of bog that has now been cutover and reclaimed for forestry and agriculture. Hodgestown Bog is separated by a mineral ridge from Ballynafagh SAC (391) and together these are two of the bogs at the eastern extreme of the range of raised bogs in Ireland. Although Hodgestown bog has no pools there are hummocks throughout the high bog and there is also a small hummock/hollow complex. Cutover is found all around the high bog.

Much of the high bog has vegetation typical of a Midland Raised Bog, consisting of Ling Heather (*Calluna vulgaris*), White Beak-sedge (*Rhynchospora alba*), Cranberry (*Vaccinium*

oxycoccos) and Bog-rosemary (*Andromeda polifolia*). The bog moss *Sphagnum tenellum* is common on the bog as is White Beak-sedge. Hummocks of the bog moss *Sphagnum capillifolium* are also common but only one hummock of *S. imbricatum* was recorded. The bog moss *S. magellanicum* is also frequently seen on the bog, in hollows with *S. tenellum* or with *S. cuspidatum* in in-filling old drains. In areas of the bog where there are signs of disturbance and bare peat patches are found the moss *Campylopus introflexus*, Deergrass (*Scirpus cespitosus*), Bog Asphodel (*Narthecium ossifragum*), Ling Heather and Cross-leaved Heath (*Erica tetralix*) tend to dominate. Much of the site was burnt in the 1970s but a subsequent survey reported that the bog was recovering well with active *Sphagnum* regeneration. There was a swallow hole in the east of the bog, with an associated soak area where the bog mosses *S. palustre* and *S. recurvum* were recorded, but this area has now been cutover. The high bog is surrounded by cutover much of which has been planted with coniferous forestry, especially in the south and east of the site.

Current landuses on the site include peat-cutting and forestry. Active peat-cutting is taking place all around the margins of the high bog. Coniferous forestry has been planted on much of the cutover, except in the north of the site. However, except for a small area on the west of the site most of the forestry has been felled. Damaging activities associated with these landuses include drainage throughout the site and burning of the high bog. All these activities have resulted in the loss of habitat, damage to the hydrological status of the site, and pose a continuing threat to its viability.

Hodgestown Bog NHA is a site of considerable conservation significance comprising as it does a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. This site supports a good diversity of raised bog microhabitats, including hummocks. Ireland has a high proportion of the total E.U. resource of raised bog (over 50%) and so has a special responsibility for its conservation at an international level.

SITE NAME: MOUDS BOG

SITE CODE: 002331

Mouds Bog is located about 3 km north-west of Newbridge in Co. Kildare, close to the Hill of Allen, and includes amongst others, the townlands of Grangehiggin, Barretstown and Hawkfield. The site comprises a raised bog that includes both areas of high bog and cutover. Much of the margins of the site are bounded by trackways.

The site is a candidate Special Area of Conservation selected for active raised bog, degraded raised bog and Rhynchosporion, habitats that are listed on Annex I of the E.U. Habitats Directive. Active raised bog comprises areas of high bog that are wet and actively peat-

forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration. The Rhynchosporion habitat occurs in wet depressions, pool edges and erosion channels where the vegetation includes White Beak-sedge (*Rhynchospora alba*) and/or Brown Beak-sedge (*R. fusca*), and at least some of the following associated species, Bog Asphodel (*Narthecium ossifragum*), Sundews (*Drosera* spp.), Deergrass (*Scirpus cespitosus*), Carnation Sedge (*Carex panicea*).

The site consists of two basins of high bog separated by a central ridge. Otherwise the bog is flat with slopes at its margins. An area of wet quaking bog with well developed pools occurs either side of the central ridge. The western high bog supports a number of small flush areas along with a wet quaking soak with scattered Downy Birch (*Betula pubescens*). The margins have extensive areas of cutover, especially to the west.

This is an example of a Midland Raised Bog at the eastern extremity of its current range with typical species including Ling Heather (*Calluna vulgaris*) along with Bog rosemary (*Andromeda polifolia*) and Cranberry (*Vaccinium oxycoccos*). The central high bog supports wet flat quaking areas on both sides of the mineral ridge with frequent small pools supporting bog mosses (*Sphagnum cuspidatum*, *S. magellanicum*, *S. capillifolium*) and Greater Sundew (*Drosera anglica*). Abundant Ling Heather dominates the drier central ridge. The three flush areas along the southern perimeter of the east and west dome support a hummock/hollow system with Ling Heather, Bog-myrtle (*Myrica gale*) and in places Crowberry (*Empetrum nigrum*) - the wet hollows support a variety of bog mosses which include *S. tenellum*. A wet quaking soak to the south supports abundant bog moss (*S. cuspidatum*) and tall Common Cottongrass (*Eriophorum angustifolium*). Cutover areas to the north-east support Purple Moor-grass (*Molinia caerulea*), Soft Rush (*Juncus effusus*) with encroaching Downy Birch and Gorse (*Ulex europaeus*) in places.

Red Grouse, a Red listed species and one that is becoming increasingly rare in Ireland, has been recorded on this site. Other birds noted on the site include Skylark, Meadow Pipit, Curlew and Kestrel.

Current landuse on the site consists of peat-cutting, with extensive active industrial peat moss production in the western section of the remaining high bog. Domestic turf cutting is widely practised along the southern margin of the bog, in the south-west corner and in the centre of the northern edge. Apart from the western cutover margin, the high bog is not being actively drained. Some small areas of the cutover have been reclaimed for agriculture in recent years. Burning has taken place in the recent past, and there is extensive damage in the west of the site due to industrial peat production. These are all activities that have resulted in loss of habitat and damage to the hydrological status of the site, and pose a continuing threat to its

viability. Despite the damaging effects the high bog has retained some wet areas largely due to the topography of the site.

Mouds Bog is significant in terms of its high bog area and geographical location as it is at the eastern extreme of the range of raised bogs in Ireland. It is a site of considerable conservation significance comprising a large raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. This site supports a good diversity of raised bog microhabitats including hummock/hollow complexes, pools and flushes, and cutover which add to the diversity and scientific value of the site. Active raised bog is listed as a priority habitat on Annex I of the E.U. Habitats Directive. Priority status is given to habitats and species that are threatened throughout the E.U. Ireland has a high proportion of the total E.U. resource of this habitat type (over 60%) and so has a special responsibility for its conservation at an international level.

APPENDIX 2.9.1
Archaeological Monitoring of Peat Stripping at Drehid, March 2007
by John Turrell and Rupert Flood

License No.: 06E0746

Planning Ref: 04/371

Archaeological Monitoring of Peat Stripping At Drehid Bog, Co. Kildare

By

John Turrell

& Rupert Flood

Client

Bord na Mona

Date

March 2007

Contents.

Figures and Plates.

Abstract.

Monitoring took place of peat stripping associated with Phase One of the development of a waste management facility in the Bord na Móna bog at Drehid, Co. Kildare. This phase of the development consisted of the construction of a five-kilometre access road, clearing the area for the waste management site and opening a quarry site in the bog to extract stone for constructing the access road. Nothing of archaeological interest was found during the course of this monitoring, which took place from the 14th of August to the 15th of December 2006.

1. Introduction.

The bog is situated largely within the townlands of Drehid, Timahoe East, Timahoe West, Loughnacush, Kilkeaskin, Drummond, Coolcarrigan, Ballynakill Lower, Ballynakill Upper, Killinagh Lower, Killinagh Upper, Allenwood North and Parsonstown, with the town of Edenderry to the west and Prosperous to the east. Carbury Hill is to the north and the Hill of Allen to the south (Fig. 1). A third class road, the L5025, divides the bog into northern and southern halves. The southern half of the bog, where the development took place, is roughly five thousand acres. This phase of the development consists of the construction of a five kilometre access road with drains, from the regional road R403 to the proposed waste facility site (Fig. 2). The waste facility, or cell, when finished, will measure approximately 470m by 470m. However, the first phase of this development only concerns works being carried out in the southern half of the cell and the construction of a perimeter road around the entire cell. To construct the access road, an area of peat approximately 200m by 400m was stripped and the underlying stone and gravel was removed for the road. Two timber trackways had been previously excavated to the north of the development and a rectangular enclosure had been recorded on the Ordnance Survey maps, close to the southern limit of the access road. All peat stripping was carried out using mechanical diggers fitted with grading buckets.

2. Historical and archaeological background.

A detailed historical and archaeological background was conducted for the EIS stage of development and is summarised here[1]. Drehid bog is in the barony of Carbury, Co. Kildare. Although known as Drehid bog, after Drehid townland, the bog is also known as Timahoe. The name Timahoe means the 'House of Mochuadh', (O'Donovan, 2002) and refers to Saint Mochuadh who founded a church here in the fifth century. Before it was known as Carbury, the area was known as Sidh Neachtain or 'The Fairy Hill'. The name derived from Nuadha Neacht of Neachtain, who was High King of Ireland for a year, before being slain in 45 AD.

[1] 'Drehid Wast Management Facility EIS', TES Consulting Engineers.

There are also myths associated with the Hill of Allen to the south of the site. It was here that "*Almhuin* (was) the palace of Fionn Mac Cumhal in Leinster", (O'Donovan, 2002, 100), *Almhuin* being the Hill Of Allen. The Annals of The Four Masters records two battles being fought here in 526 AD and 718 AD. The River Boyne, which rises 4 kilometres west of the site is also associated with legends, such as the Salmon of Knowledge.

The last reference to Sidh Neachtain was in the Annals of the Four Masters which records the death of Laoghaire, High King of Ireland, who died at Sidh Neachtain in 458. The area then becomes known as 'Cairbre Og Ciartha' or Carbury. Cairbre was Laoghaires' brother and he and his dynasty controlled the area until the Norman period when Meider Fitzhenry was granted the Carbury area. Fitzhenry subsequently lost the property in 1181.

The next major holders of the Carbury lands were the Fitzgeralds who were a powerful family in Ireland, the 7th Earl serving as Chief Governor of Ireland on a number of occasions. Unfortunately for the Fitzgeralds, their power came to an end because of their involvement in the 1641 rebellion. Timahoe, after changing hands a number of times, was eventually leased to a group of Quakers from Northern Ireland, in the 18th century.

The bog played an important part in the 1798 rebellion in North Kildare. "The Prosperous and Clane rebels formed a camp at Timahoe ….it was sited on Hodgestown Hill…" (Cullen, 1998, 13).This was an area of dry land within the bog thus making access almost impossible for English cavalry and artillery. At one point there were almost 2,500 rebels camped there, growing to 4,000 when rebels from Wexford and Wicklow joined them. This latter group moved on however after just a day, (Ibid, 25).

A detailed archaeological background was conducted by TES Consulting Engineers for the EIS. North of the waste facility site were two substantial trackways or toghers, (KD009-018 & 019, also known as KD008-029 & 030). These were excavated by E. Rynne in the 1960's and by Monroe in 1986, (O'Carroll, 2002). One of the trackways was a substantial oak plank track whilst the other was a flimsy birch trackway. Monro, (1987, 22) thought that the trackways were broadly contemporary and tree ring dating placed the oak plank track in the Middle Bronze Age. A site visit in 2002 by Ellen O'Carroll and a walk over survey conducted in the course of the preparations for the EIS, could find no extant trace of the two toghers. A full list of recorded monuments in the area is given in Table 2.

South of the access road at its southern limit, a rectangular enclosure (KD012-005) was shown on the early Ordinance Survey maps but is no longer extant today. The two trackways

mentioned above are the earliest dated monuments in this area but some of the enclosures in the surrounding area may be prehistoric in date (Table 2). Prehistoric activity is attested to by stone axeheads found within the bog and the surrounding area (Table 3). Bronze artefacts such as socketed axehead, spearhead and rapier also indicate prehistoric activity here. Moving into the historic period, there are more dateable monuments such as the ringfort at Mulgeeth and the castle at Timahoe West. There is a church and graveyard at Timahoe East and also at Ardkill. A full list of stray finds from the area is given in Table 3.

The bog is part of Bord na Móna's Allen group of bogs which were the first to be industrially worked in the fifties. Most of this bog has been cut away with the poor quality of the remaining peat and the underlying gravel making further peat harvesting uneconomical. Production on the bog here has been gradually phased out over the last fifteen to twenty years.

3. Results.

3.1. Site access road.

The road was some 5 kilometres long stretching from the R403 in the southwest. For the initial 210 metres, through reclaimed agricultural land, the topsoil was a mid-brown clayey silt, 0.15 -0.4m deep. After this the subsoil began to give way to peat. This was black in colour and dried out but fibres of such plants as *Calluna* (Heather) and *Eriophorum* (Bog Cotton) were still visible, with occasional tree stumps in this. The peat here had a maximum depth of 2.4m. At 370m, from R403, there was a particularly deep patch of soft marl, approximately 1.5 metres deep, which had to be removed. This carried on for quite a distance, almost up to the present day margin of the bog, about 550m from R403.

From here, the road cut through up to 6m of uncut (virgin) bog (Plate 1), for a distance of approximately 200m, in a northeasterly direction. The peat here was reddish brown, poorly humified and contained frequent *Sphagnum cuspidatum* (Pool Moss) and occasional *Eriophorum* and tree roots. It then emerged into cut bog proper and carried on, through up to 3m of peat, into the centre of the bog before turning northwards to reach the waste management facility. The average width of the road was 8m and, in an effort to divert water and thus avoid subsidence, drains approximately 0.5 to 0.7 metres wide, were cut through the peat on both sides of the road. Any underlying marl was also removed from along the path of the road as this marl had a tendency to travel up through freshly laid gravel when heavy vehicles passed over it and cause subsidence. This marl was light to mid grey in hue and consisted of a sandy/stony silt.

The peat throughout the bog was a *Sphagnum* peat and ranged in depths from 0.18 to 2.5m in the cutaway portion of the bog. The peat was mid to dark brown in colour, poorly humified and contained occasional *Calluna*, *Eriophorum* and very occasional *Phragmites* (Reed). Along the uncut (virgin bog) margin of the bog, the peat was reddish brown and also poorly humified. Pool moss was in abundance here, with occasional *Eriophorum*, which often occurred in, laminated form. It was not possible to get a proper recording of the section faces here as the peat was so deep, up to 6 metres, and very unstable. Nothing of archaeological interest was noted here.

3.2. Waste facility site.

Situated at the northern terminus of the access road, this area is roughly square in plan, each side measuring approximately 470m. A road, 5m wide, was constructed around the entire perimeter of the cell. In this phase of construction, the cell was divided in two, with the southern half being stripped of surface vegetation (Plate 2). The surface was quite overgrown with a lot of *Calluna*, *Betula* (Birch) and occasional *Pinus* (Pine). The southern 120m was then stripped of all peat (Plate 3). The peat here ranged in depth from 0.3m to 1.8m and was dark brown in colour, poorly humified with occasional *Eriophorum*. The peat was quite loose, especially in the top one third of the section and occasionally contained plastic sheeting, suggesting that Bord na Móna had filled in this area to prepare a flat surface for peat harvesting. This would appear to be confirmed by the presence of three field drains in the southeast corner of the stripped area, cut into the underlying silt/marl. Nothing of archaeological interest was noted here.

3.3. Quarry site.

This was located approximately 700m south of the waste facility and on the western side the access road (Plate 6). This area measured roughly 400m east-west by 200m north-south. The area was bounded on the north and south by large arterial drains and 200m to the west was reclaimed agricultural land (Plate 4), with the access road forming the eastern boundary. The peat in this area ranged in depth from 0.3 to 3.4m and was dark brown to black in colour with occasional *Eriophorum*, sometimes laminated, with very occasional *Phragmites* and *Calluna*. One section face (Plate 5), 1.8 metres deep, had dark brown peat for the top 0.4m with moderate inclusions of *Calluna* and occasional *Eriophorum*. Below this was 0.3m of *S. cuspidatum* followed by mid brown *Sphagnum* with very occasional *Eriophorum*. There was then a thin band of gravely marl overlying 0.3m of dark brown peat. Occasional patches of loose peat and plastic fragments beneath the peat surface suggested the filling in of hollows by Bord na Móna. Areas of frequent tree roots were noted, mostly in upper third of peat but occasionally in the lower peat just above the silt/marl. The diggers often struck the

underground water table here as well as underground springs. Nothing of archaeological interest was revealed by the groundworks here.

4. Discussion and conclusions.

Although no archaeological deposits or artefacts were uncovered during the course of monitoring, the work did provide an opportunity to record the peat stratigraphy across the bog and therefore reveal something of its development (Table 1). The margin of the bog seemed to begin about 210m from the R401, where the rest of the bog up to the western side of the uncut bog was obviously reclaimed. The dryland to the west of the quarry was reclaimed wetland (Plate 4), as was the dryland along the southern end of the access road. The peat appeared to be quite uniform across the bog, typically, a poorly humified *Sphagnum* peat with occasional inclusions of *Eriophorum* and *Calluna.* There were very occasional inclusions of *Phragmites* with one particular cluster of this reed type along the access road, just south of the quarry. Pool moss was also found throughout the bog, especially in areas where the peat was at a depth of two metres or more. This was especially evident in the non-cutaway bog on the present day margin, where depths of up to 6m were recorded. Some tree roots were also recorded, usually about 0.5m above the marl/peat interface. Another interesting feature that was noted in the quarry was the presence of a thin band of marl/gravel within the peat and averaging 0.3m above the main marl/peat interface (Plate 5).

Putting this evidence together then, it can be seen that the area was under water, hence the formation of marl above the gravel. This was followed by a period of relative dryness when peat began to form, which became even dryer when trees began to root in areas throughout the bog. Eventually climatic conditions worsened and the peat began to form again, as evidenced by the pool moss found throughout the bog. The thin layer of marl within the peat in the quarry may be explained as a localised pond or small lake that obviously formed for a relatively short time, early in the bog's development.

It was interesting to note the surface growth on the bog after a minimum of ten years uninterrupted growth after peat harvesting and other Bord na Móna works had ceased (Plate 2). In many areas *caluna* and *eriophorum* were the dominant species but in areas that had a lot of growth, broad-leafed bushes and trees colonised the bog. Birch trees especially seemed suited to the environment there. Only very occasionally was a coniferous tree noted in the bog but with very little growth. There were some pine trees on the reclaimed land west of the quarry but these appeared to be the exception.

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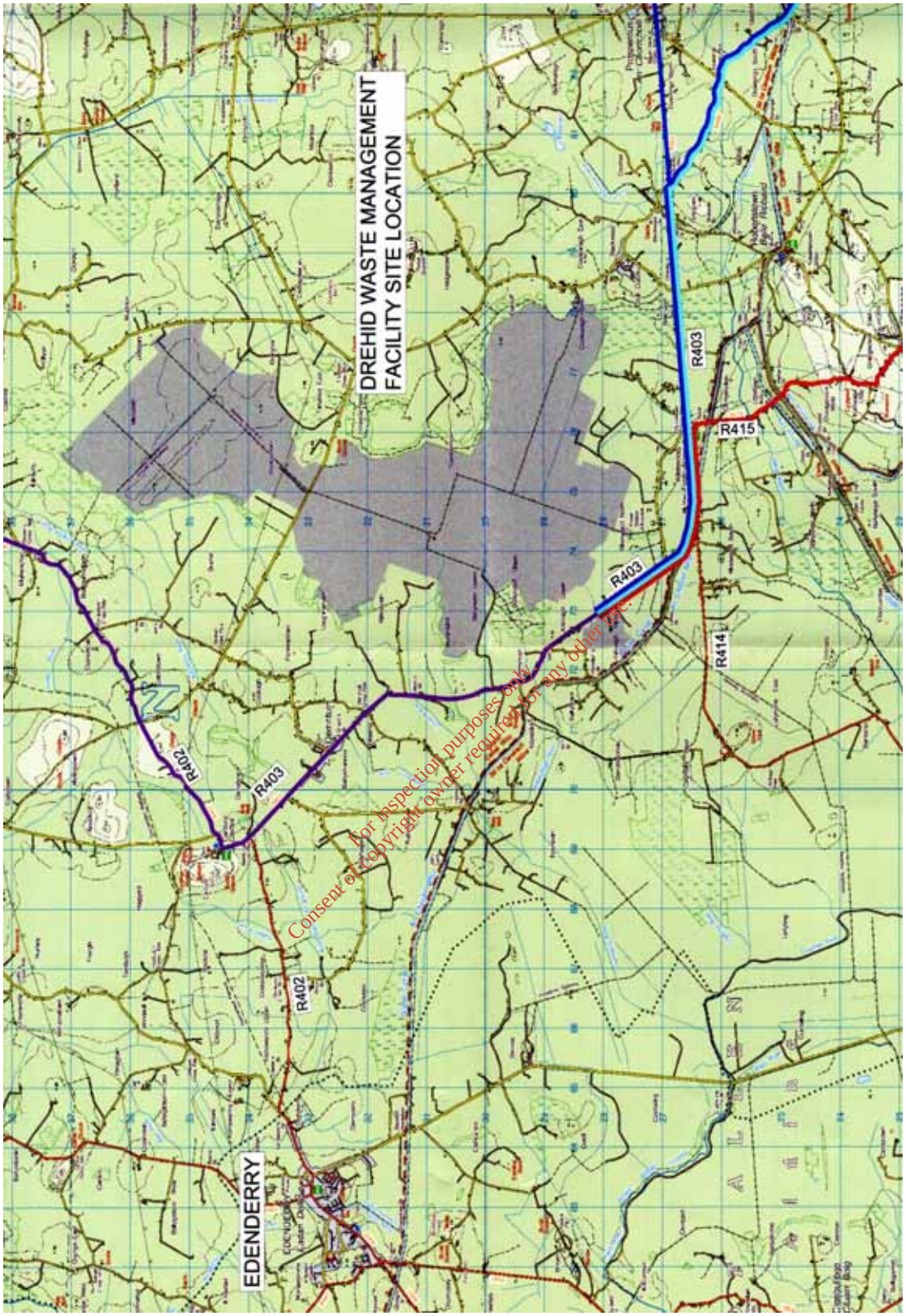

Figure 1. Site location.

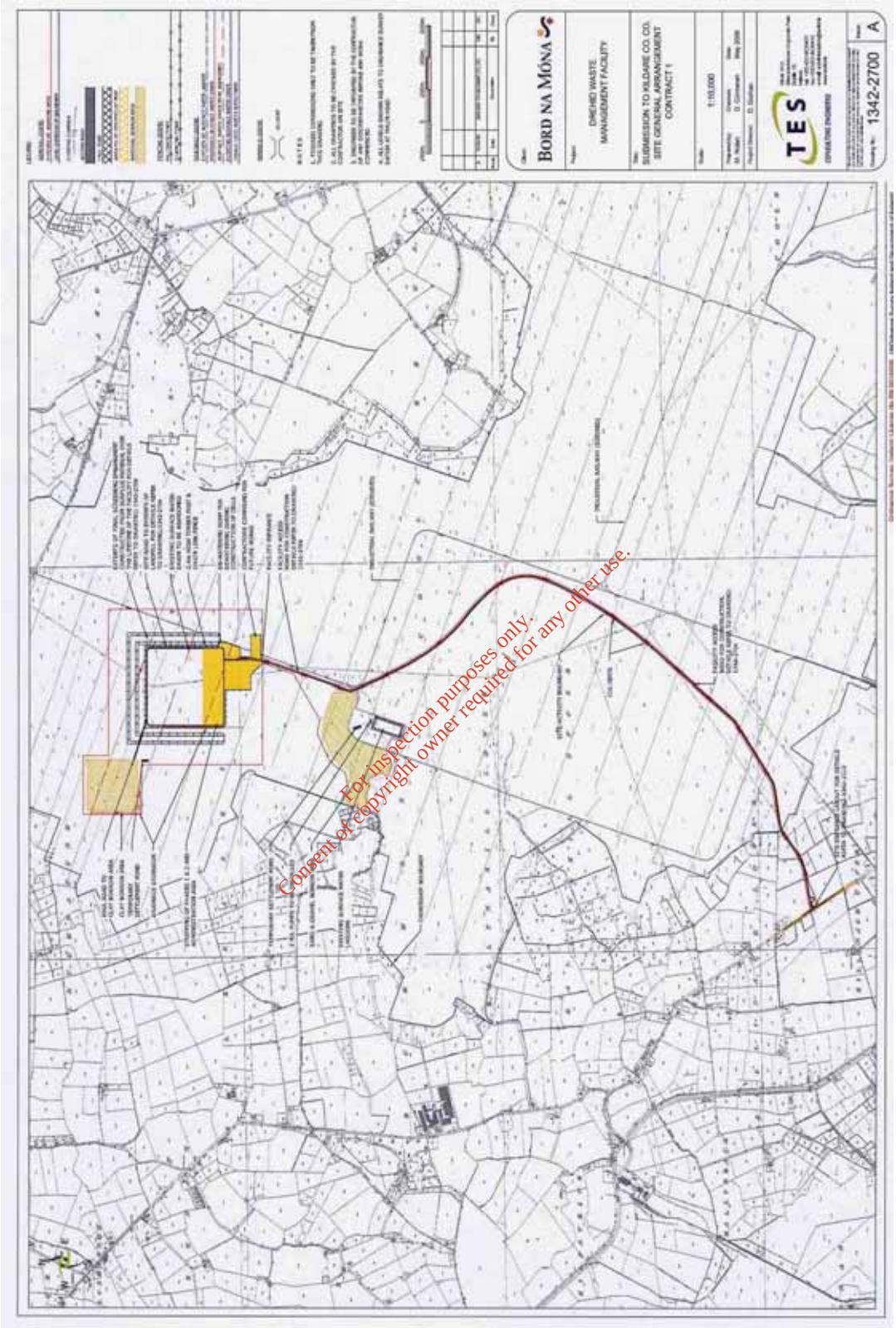

Figure 2. Site, showing location of development.

Plate 1. Showing uncut bog.

Plate 2. Stripping the cell of vegetation, note vegetation growth in background as an indication of how long the bog has been out of production.

Plate 3. The cell stripped of peat.

Plate 4. Reclaimed agricultural land, note peat in boundary bank at centre left of photo.

Plate 5. Quarry, showing thin layer of gravely marl within peat section.

Plate 6. Quarry.

Table 1 Peat Depths Along Length of Access Road.

Chainage	Depth	Inclusions	Coordinates
5000m	0.6m	Caluna	274487/231767
4970m	0.5m	Caluna	
4940m	1.2m	Caluna	
4910m	2m	Caluna, small tree branches	
4880m	1.5m	Caluna, small tree branches, freq. Phragmites	
4850	1.7m	freq. Phragmites, eriophorum, twigs and mod. Roots	274493/231643
4820m	2.7m	Phragmites,roots, very occa. caluna, mod. Eriophor	
4790	2.5m	Eriophorum, pool moss, freq. Twigs and roots	
4760	2.3m	Eriophorum, pool moss, freq. Twigs and roots	274489/231562
4610	2.5m	Pool moss, large tree roots,	
4590	2m	Pool moss, tree roots	274427/231370
4565	2.2m	Pool moss, laminated eriophorum, caluna, tree root	274403/231307
4475	2.6m	Eriophorum, freq. tree roots.	
44425	1.1m	Small tree roots at interface of peat & marl	
4410	1.7m	Tree roots and trunks in upper half of peat	
4375	1.7m	Caluna	
4345	1.9m	Caluna	
4315	1.8m	Small tree roots	
4285	0.9m	Access to quarry area, Caluna	274296/231022
4255	2.5m	Freq. pool moss and caluna	
4225	4.3m	Freq. pool moss and caluna and tree root	
4195	4m	Freq. Pool moss and phragmites	
4165	3.4m	Moderate pool moss and caluna	
4135	1.2m	Freq. pool moss	
4105	1.1m	Mod. pool moss and freq. Phragmites	
4075	0.8m	Caluna and phragmites	
4045	0.7m	Small tree roots	
4015	0.8m	Freq. Phragmites	
3985	1.1m	Phragmites	
3955	0.4m	Caluna	
3925	0.1m		
3895	0.25m	Phragmites and freq. tree roots	
3865	0.4m	Eriophorum and moderate small roots	
3835	0.4m	Eriophorum and moderate small roots	
3805	0.5m	Laminated eriophorum, roots, bark fragments	
3775	0.8m	Laminated eriophorum, small roots and caluna	
3745	0.6m	Very occa. eriophorum and small roots	
3715	0.4m		

Chainage	Depth	Inclusions	Coordinates
3685	0.1m		
3655	0.5m		
3625	0.5m	Eriophrum and small roots	
3565	0.25m	Tree roots	
3535	0.16m	Tree roots	
3325	1.1m	Tree roots	274776/230254
3145	1.9m	eriophorum and tree roots	274905/230134
3050	2.3m	Calluna, tree roots and twigs	
3020	2.1m	Calluna, tree roots and twigs	
2990	1.2m	Calluna, tree roots and twigs	274990/229999
2960	1.1m	Calluna and tree roots	
2930	0.95	Calluna, tree roots and twigs	
2900	0.9m	Calluna, tree roots and twigs	
2870	1m	Calluna and tree roots	
2840	0.9m	Calluna and tree roots	
2810	0.9m	Calluna, tree roots and twigs	
2780	0.8m	Calluna and tree roots	
2750	0.9m	Calluna and tree roots	
2720	1.1m	Eriophorum, calluna, pool moss	
2690	0.8m	Eriophorum, calluna, pool moss	
2660	0.9m	Eriophorum and calluna	
2630	0.6m	Calluna	
2600	0.6m	Twigs and eriophorum	
2570	0.45m	Calluna	
2540	0.4m	Calluna	
2510	0.55m	Calluna	
2480	0.55m	Calluna	
2450	0.3m	Calluna	
2420	1.15m	Calluna	
2390	1.1m	Calluna, tree roots and branches	
2360	1.55m	Calluna and large tree trunk	274761/229357
2330	0.55m	Calluna and mid to large tree trunks	
2300	0.6m	Calluna	
2270	0.7m	Calluna	
2240	0.7m	Calluna, eriophorum and mid sized tree trunks	
2210	0.4m	Calluna and eriophorum	
2180	0.95m	Calluna and eriophorum	
2070	1.1m	Calluna and eriophorum	
2040	1.1m	Calluna and eriophorum	
2010	1m	Calluna	
1980	1m	Calluna	

Chainage	Depth	Inclusions	Coordinates
1950	1.1m	Calluna and mid sized tree trunks	
1920	1.2m	Calluna and eriophorum	
1890	1.2m	Eriophorum and twigs	
1860	1.1m	Eriophorum and twigs	
1830	1.3m	Eriophorum, calluna and pool moss	
1800	1.7m	Eriophorum and calluna	
1770	1.7m	Calluna	
1740	1.6m	Eriophorum and calluna	
1710	1.7m	Calluna and roots	
1680	1.7m	Calluna and roots	
1650	1.2m	Eriophorum, calluna and pool moss	
1610	1.6m	Eriophorum and calluna	
1580	1.6m	Calluna and pool moss	
1550	1.7m	Eriophorum and calluna	
1520	1.8m	Eriophorum, calluna and pool moss	
1490	1.7m	Calluna and tree roots	
860	4m	Eriophorum, single tree trunk and freq. pool moss	
830	6m	Freq. eriophorum, freq. pool moss and occa. Root	
800	6m	Eriophorum, tree root and freq. pool moss	
665	6m	Freq. pool moss	
600	6m	Freq. pool moss and freq. tree root in lower half	
570	6m	Freq. pool moss and freq. tree root in lower half	
550	3.3m	Freq. pool moss, laminated eriophorum	
530	2m	Eriophorum in bottom half, calluna & freq. Roots	
490	2.4m	Eriophorum, brushwood and roots	
453	1.6m	Eriophorum, brushwood and roots	
443	1.5m	Eriophorum	
390	0.8m	Eriophorum, soft marl was 1.5m deep	
210	0.1m	Edge of bog, eriophorum	
110	0.15-0.4 m	Mid brown, clayey silt, mid-sized subangular stone	

Table 2 Recorded Monuments in the Area.

SMR Number	Townland	Site Type
KD009-018 & KD08-030	Timahoe East & Kilkeaskin	Togher
KD009-019 & KD08-029	Timahoe West & Loughnacush	Togher
KD008-028	Timahoe East	Togher
KD008-025 & KD09-017	Drehid	Togher
KD009-006	Timahoe West	Togher
KD012-002& KD012-003 & KD012-004	Ticknevin	Togher
KD008-025 & KD009-017	Drehid	Togher
KD008-026	Drehid	Togher
KD008-027	Drehid	Togher
KD008-007	Collinstown	Enclosure
KD008-019	Rathmore	Enclosure
KD008-024	Drehid	Enclosure
KD009-007	Coologmartin	Oval Enclosure
KD009-010	Giltown	Enclosure
KD012-005	Killinagh Upper	Rectangular Enclosure
KD008-016	Parsonstown	Ringfort
KD008-023	Parsonstown	Ringfort
KD009-001	Mulgeeth	Ringfort
KD013-001	Coolearagh West	Ringfort
KD013-002	Coolearagh West	Ringfort
KD012-008	Ticknevin	Holy Well
KD008-009	Ardkill	Church & Graveyard
KD009-008	Timahoe East	Church & Graveyard
KD008-020	Collinstown	Church Site
KD009-006(01)	Timahoe West	Childrens Burial Ground
KD012-001	Kilpatrick	Burial Ground
KD008-008	Ardkill	Castle
KD009-009	Timahoe West	Castle

Table 3 Stray Finds from the Area.

Townland	NMI Register Number	Artifact type	Find Circumstance
Ardkill	1937:2433	Stone Axehead	N/A
Ballybrack	1937:2421	Stone Axehead	N/A
Downings	1945:268	Stone Axehead	N/A
Kilkeaskin	1937:2420	Stone Axehead	N/A
Kilkeaskin 'The River Field'	1968:438 & 439	2 Stone Axeheads	N/A
Mylerstown	1991:44	Stone Axehead	Field Close to Bog
Timahoe East	1938:8560	Stone Axehead Fragment	N/A
Timahoe West	1966:2	Flint Arrowhead	Bog Find
Allenwood Middle	1942:1870	Bronze Rapier	Bog Find
Timahoe	1941:1120	Bronze Spearhead	N/A
Robertstown	1994:62	Socketed Bronze Axehead	Bog Find
Ballybrack	1937:2438-44	Stone Implement	N/A
Ballyteague	N/A	Designed Stone	Near Castle
Demesne	1950:31	Pointed Stone Object	Plough Find
Coolcarrig	1979:7	Timber Shovel Blade	Bog Find (5.5 metres deep)
Coolcarrig	1979:9	Wooden Keg With Bog Butter	Bog Find
Drehid	1972:355-A&B	Bent Wooden Stake, 2 Frags.	Bog Find (4ft deep)
Killinagh	1994:72	Timber Frag.	Bog Find
Killinagh	1929:1298	Bog Butter	Bog Find (6ft deep)
Mulgeeth	1980:46	Timber Frag.	Bog Find
Timahoe East	1943:132	Portion of Solid Wooden Wheel	Bog Find
Timahoe East	1943:130&131	Wooden Yoke & Long Perforated Timber	Bog Find
Timahoe	1950:4A&4B&4C	3 Frags. Of Wooden Vessel	Bog Find (7ft deep)
Timahoe	1942:409	Wooden Object	Derrymahon Bog (3ft deep)
Timahoe West	1970:139	Rough Out For 2 Handled Wooden Vessels	Bog Find
Allenwood South	1987:72	Leather Shoe	Bog Find (1.25 metres deep)
Ticknevin	1987:140	Leather Shoe	Bog Find
Timahoe East or West	1978:3	Leather Shoe	Bog Find
Near Drummond or Ballynakill Lower	N/A	Human Skeletal Remains	Timahoe Bog
Timahoe Bog	N/A	Bog Body-Human Forearm	Found 1959 During Works
Ballynakill Lower/Upper	1962:75	'Bearded Type' Iron Axehead	From Boggy Land
Timahoe East	1950:7	Iron Axehead	Bog Find (6ft deep)

Townland	NMI Register Number	Artifact type	Find Circumstance
Timahoe East	1943:286	Silver Bracelet	Bog Find
Allenwood South	1987:71	Bronze Cauldron (15th/16th century)	Bog Find (1.25 metres deep)

APPENDIX 2.9.2
Archaeological Figures and Photographic Plates

Plate 1 View of railway line through centre of northern section of bog.

Plate 2 Area of dense vegetation in the northern sector of bog.

Plate 3 Peat plots in southern sector of bog.

Plate 4 Surface wood in northern sector of bog.

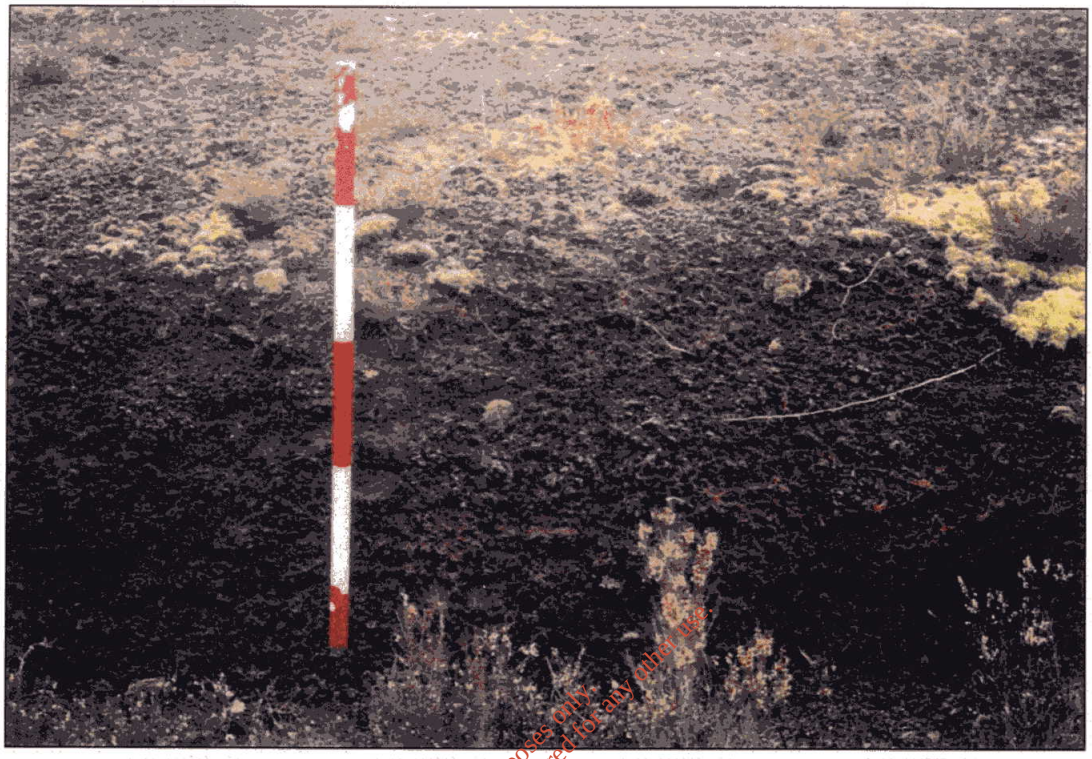

Plate 5 Drain section face in eastern sector of bog.

Plate 6 Milled area in northernmost area of bog.

Plate 7 Peat bank in northernmost area of bog.

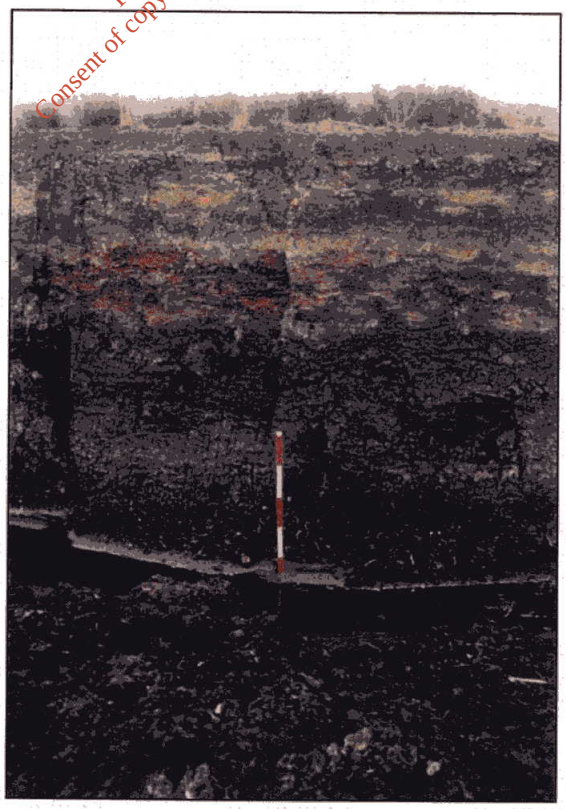

Plate 8 Detail of peat bank in northernmost area of bog.

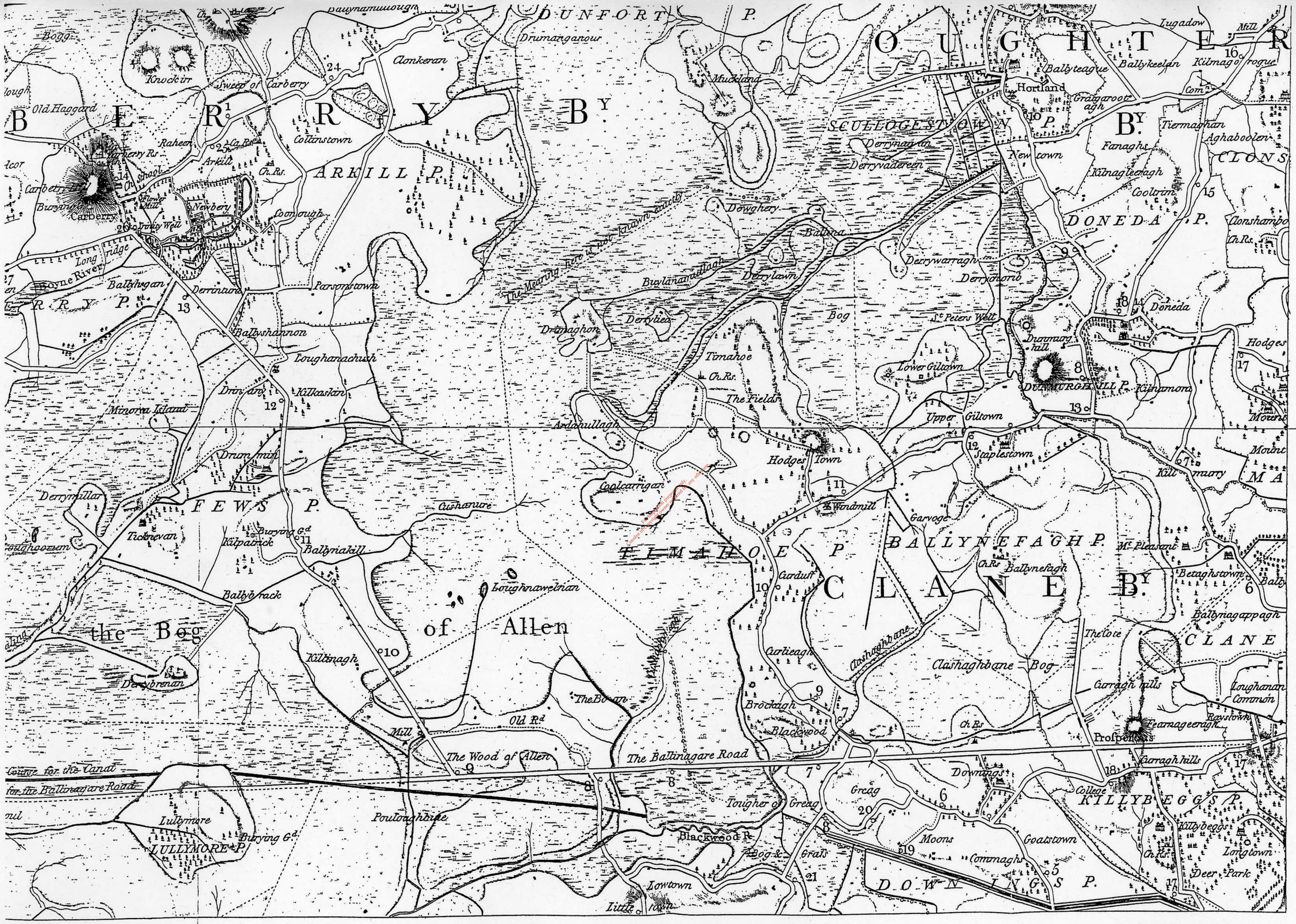

Fig. 4 Extract from Alex Taylor's map (1783) showing Timahoe and the surrounding area

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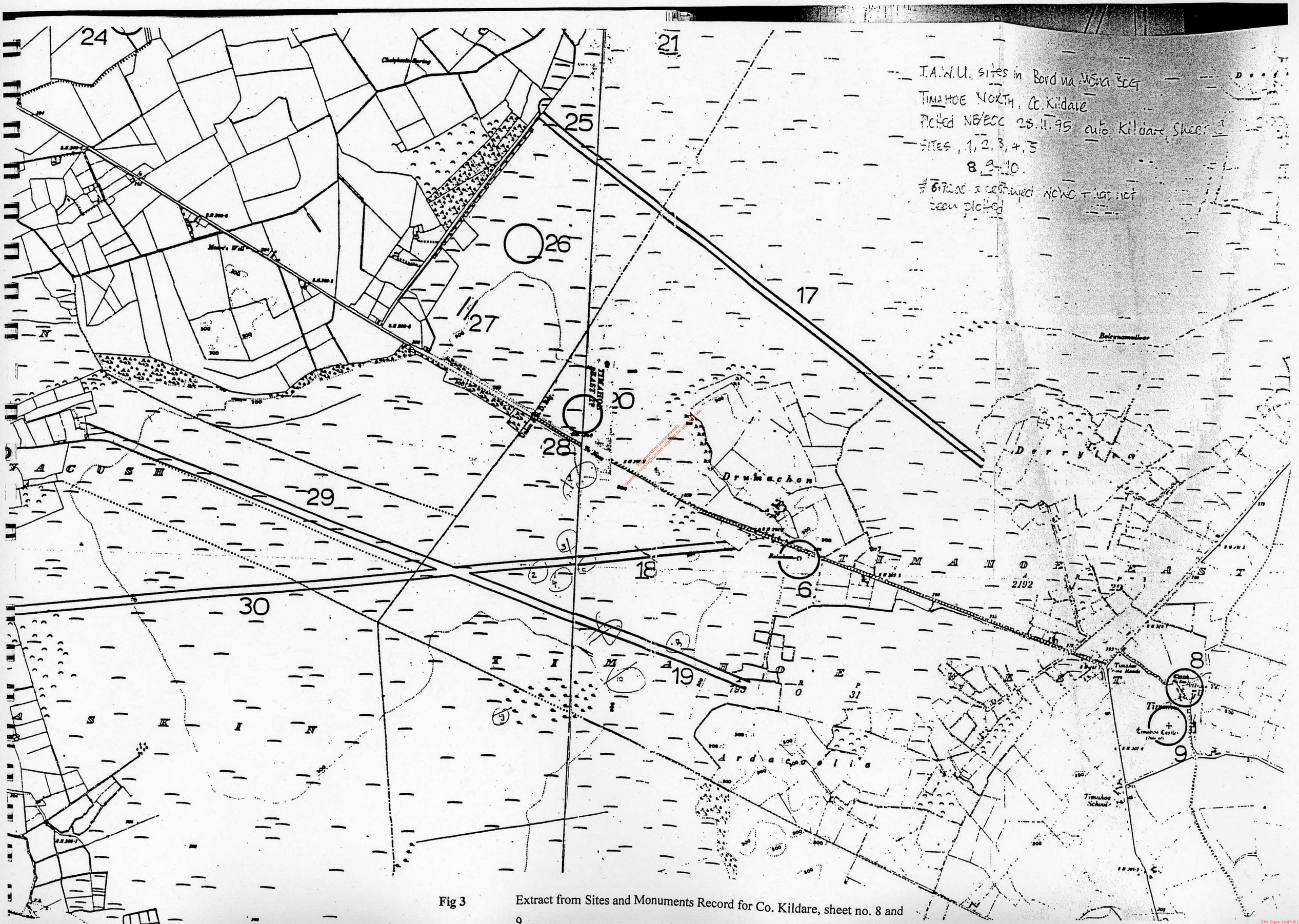

Fig 3 Extract from Sites and Monuments Record for Co. Kildare, sheet no. 8 and 9

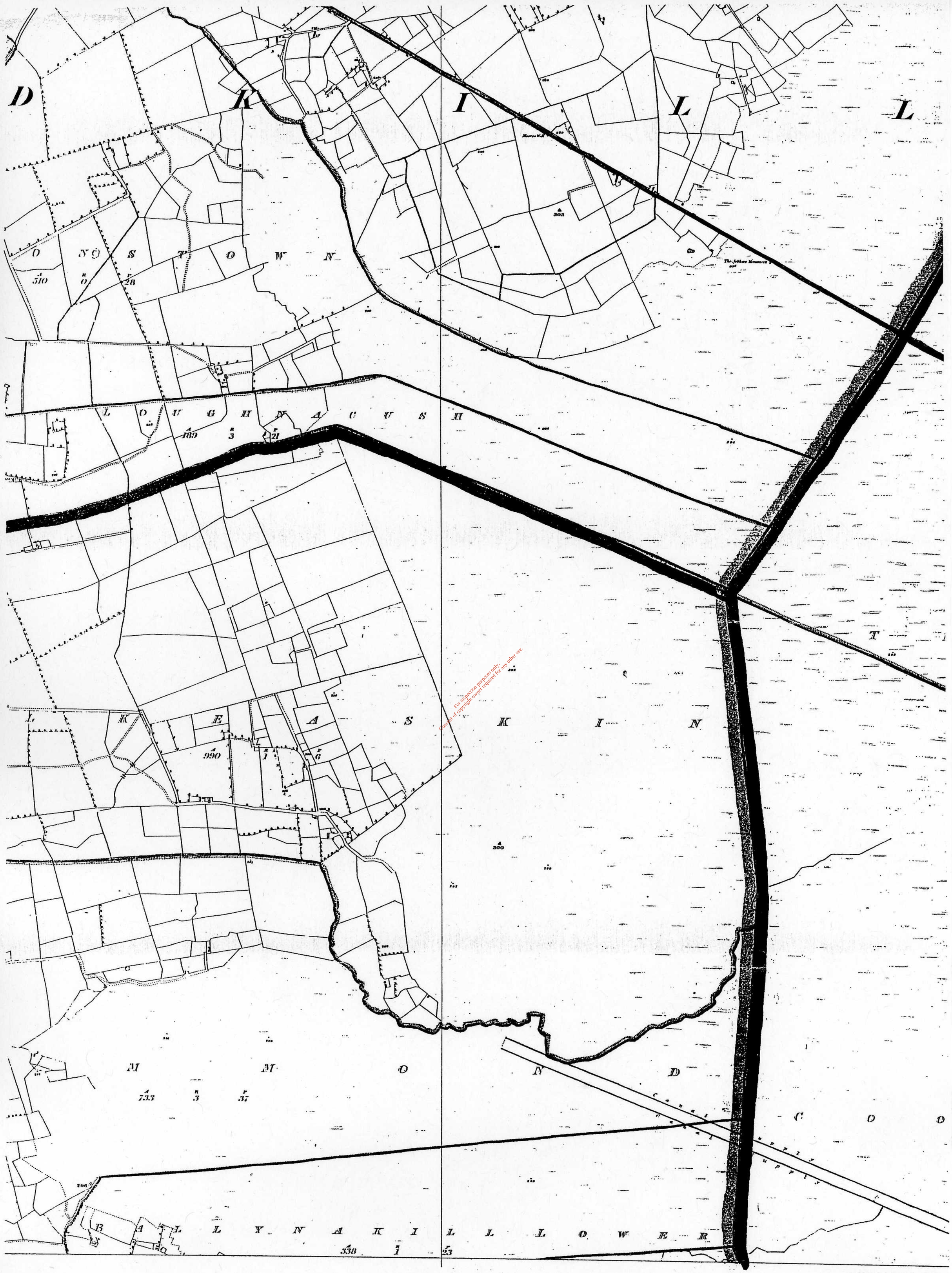

Fig. 2 Extract from first edition Ordnance Survey map for Co. Kildare, sheet 8.

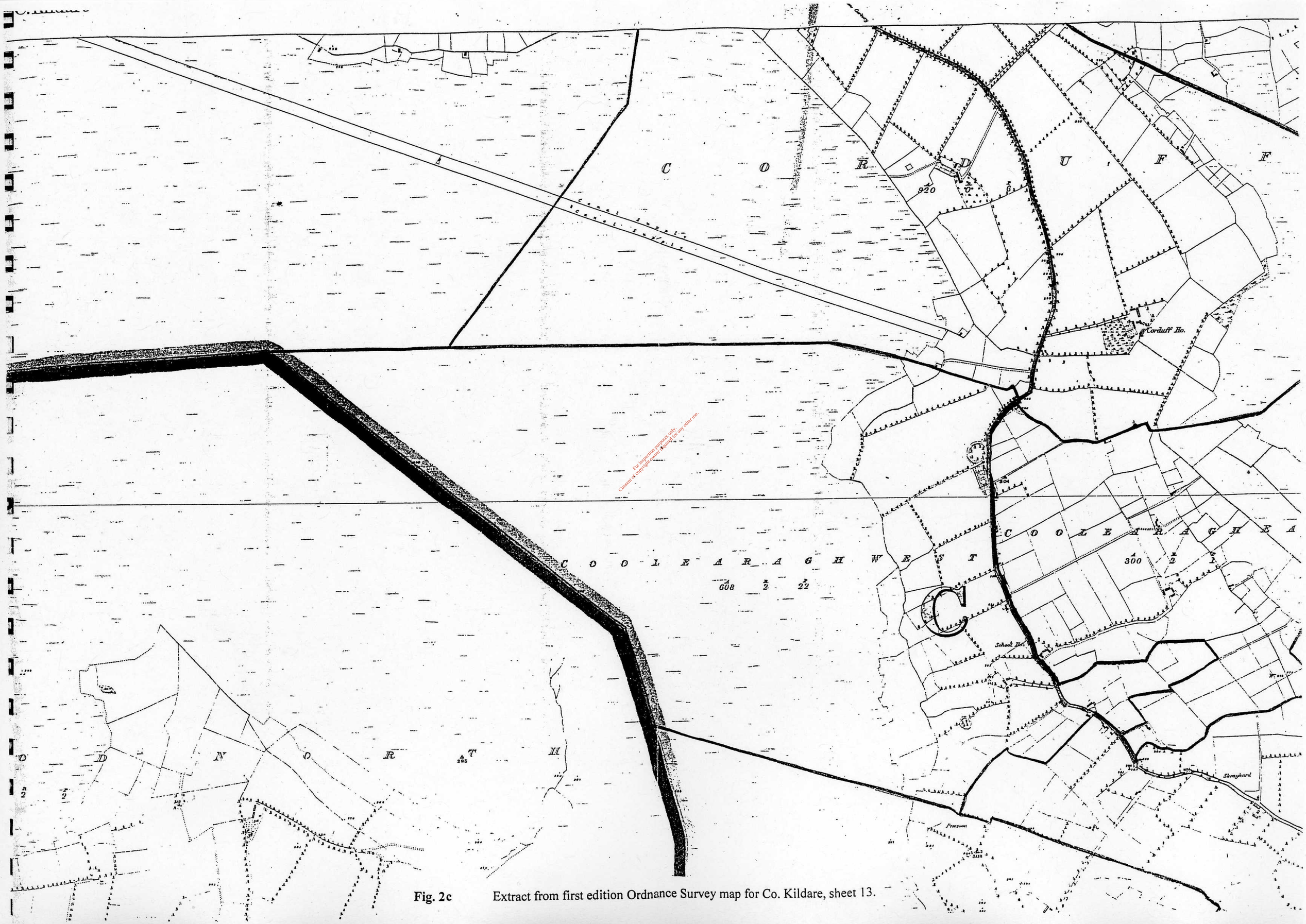

Fig. 2c Extract from first edition Ordnance Survey map for Co. Kildare, sheet 13.

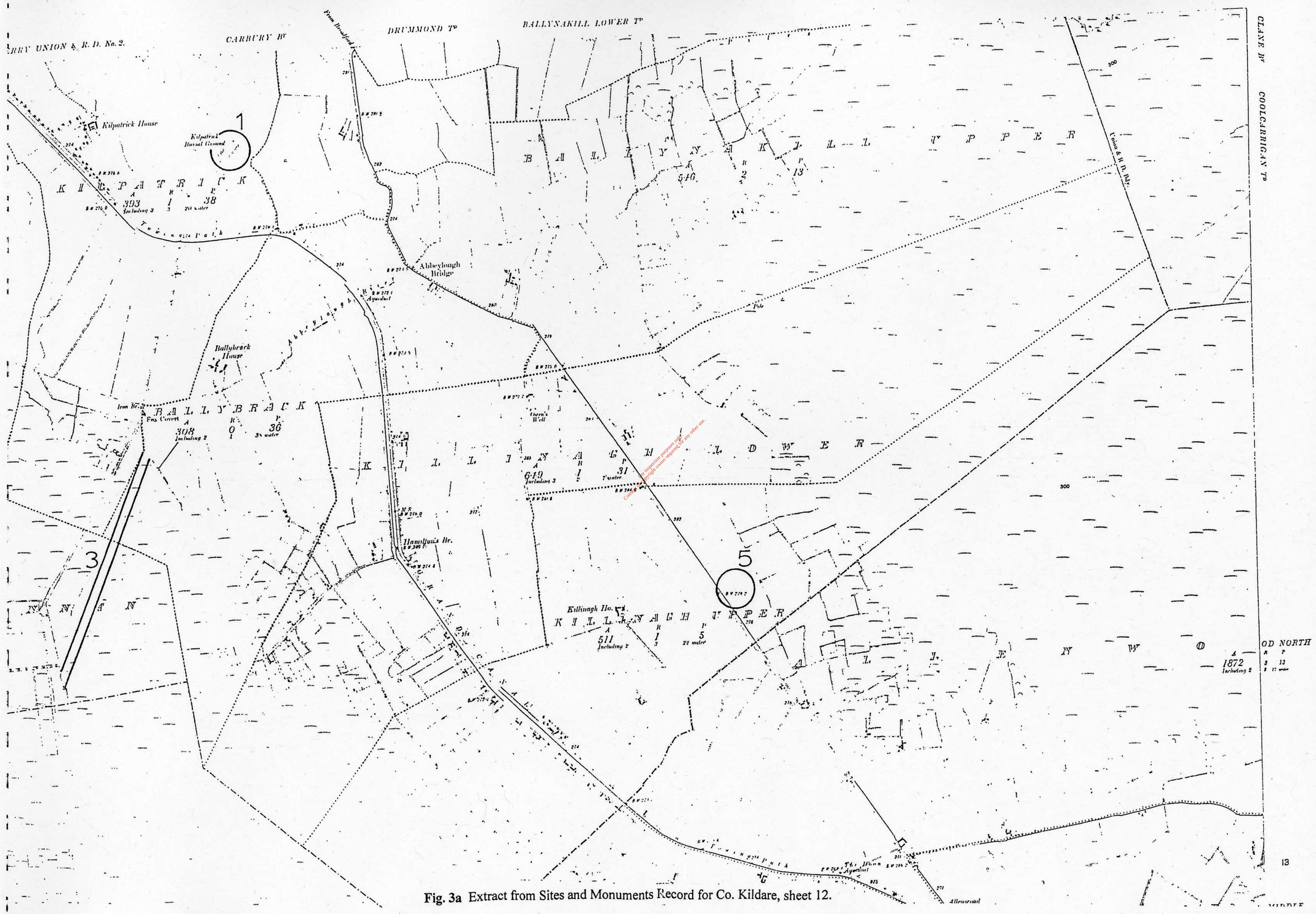

Fig. 3a Extract from Sites and Monuments Record for Co. Kildare, sheet 12.

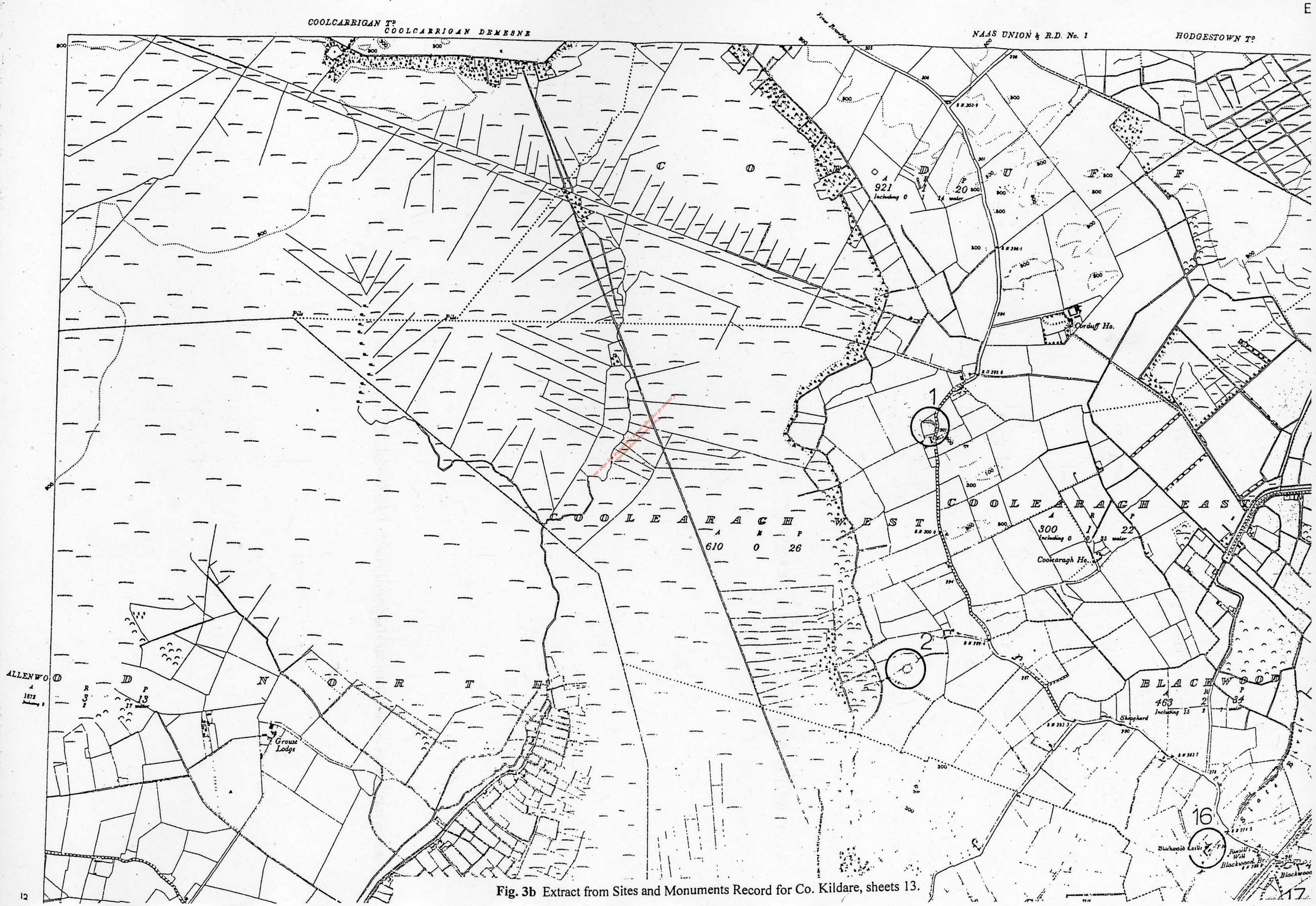

Fig. 3b Extract from Sites and Monuments Record for Co. Kildare, sheets 13.

Fig. 2b Extract from first edition Ordnance Survey map for Co. Kildare, sheet 12.

APPENDIX 3.1.1
Glossary of Terms
National Waste Database Report

APPENDIX A: GLOSSARY OF TERMS

(Reference to *Schedules* in definitions refer to the Waste Management Act, 1996)

Waste Any substances or object belonging to a category of waste, specified in the *First Schedule* or included in the EWC, which the holder discards or intends or is required to discard and anything which is discarded or otherwise dealt with as if it were waste shall be presumed to be waste until the contrary is proved.

Household Waste Waste produced within the curtilage of a building or self-contained part of a building used for the purposes of living accommodation.

Commercial Waste Waste from premises used wholly or mainly for the purposes of a trade or business or for the purposes of sport, recreation, education or entertainment but does not include household, agricultural or industrial waste.

Industrial Waste Includes waste produced or arising from manufacture or industrial activities or processes.

Municipal Waste Household waste as well as commercial and other waste which, because of its nature or composition, is similar to household waste.

Inert Waste Waste that, when deposited into a landfill, does not undergo any significant physical, chemical or biological transfer.

Packaging Waste Any packaging or packaging material covered by the definition of waste in Directive 75/442/EEC.

Packaging Any material, container or wrapping, used for or in connection with the containment, transport, handling, protection, promotion, marketing or sale of any product or substance including such packaging as may be prescribed.

Hazardous Waste Means- (i)hazardous waste for the time being mentioned in the list prepared pursuant to Article 1 (4) of Council Directive 91/689/EEC of 12 December, 1991, being either

(I) Category I waste that has any of the properties specified in Part III of the *Second Schedule*, or

(II) Category II waste that

(A) contains any of the constituents specified in Part II of the *Second Schedule*, (B) has any of the properties specified in Part III of the said *Schedule*,

(ii) such other waste, having any of the properties specified in Part III of the *Second Schedule*, as may be prescribed for the purposes of this definition.

Disposal In relation to waste, includes any of the activities specified in the *Third Schedule*, and waste disposal activity shall be construed accordingly.

Recovery	In relation to waste, means any activity carried on for the purposes of reclaiming or re-using, in whole or in part, the waste and any activities related to such reclamation, recycling or re-use, including any of the activities specified in the *Fourth Schedule*, and waste recovery activity shall be construed accordingly.
Recycling	The subjection of waste to any process or treatment to make it re-usable in whole or in part.
Recovery Rate	Percentage of usable recycled materials that have been removed from the total amount of waste generated in a specific area or by a specific activity.
Recycle/Re-use	Minimising waste generation by recovering and reprocessing usable products that might otherwise become waste (i.e. recycling of aluminium cans, paper bottles, etc).
Re-use	Using a product or component of municipal solid waste in its original form more than once, e.g. refilling a glass bottle that has been returned or using a coffee jar to hold nuts and bolts.
Prevention	The reduction of the quantity and of the harmfulness for the environment of waste products.
Facility	In relation to the recovery or disposal of waste, any site or premises used for such purpose.
Transfer Station	A facility where waste is unloaded in order to permit its preparation for further transport for recovery, treatment or disposal elsewhere.
Participation Rate	Percentage of the population within a catchment area of a particular waste management facility or service, actually using that facility or service.
Civic Waste Facilities (Civic Amenity Sites)	Facilities at which waste may be deposited by members of the public in accordance with any conditions for the time being specified by the local authority as respects the nature, type and quantity of waste that may be deposited, and other facilities for (i) The segregation, mixing, baling, storage or treatment of waste prior to its recovery or disposal (ii) The recovery of waste (iii) The disposal of waste (other than household).
Recycling Bring Scheme	A scheme which provides facilities in high-density areas, where waste may be deposited by members of the public, each site strategically located so as to serve an optimum amount of people in a neighbourhood.
Home Compost Scheme	Provision of home composting units (free of charge or at a subsidised price) to a designated number of households in an area.
Recycling Bring Banks	Individual stand-alone units within a neighbourhood civic amenity site, recycling bring scheme, etc. For example, bottle bank, can bank, textile bank.
Landfill	Waste disposal facility used for the deposit of waste onto or under land.

APPENDIX 3.3.1
Road Safety Audit
Letter Kildare County Council

Comhairle Contae
Chill Dara
Kildare
County Council

29/02/2008

Our Ref.: **04/371**
Your Ref: **3368-02-06**

CONSULTING ENGINEERS
FILE REF: 3368 02-6
Date Received 03 MAR 2008
PASS TO | ACTION BY | DATE

David Conneran
Tobin Consulting Engineers
Block 10-4
Blancherdstown Corporate Park
Dublin 15

RE:/ Planning Permission for development of the proposed Drehid Waste Management Facility in the townlands of Parsonstown, Loughnacush, Kilkeaskin, Timahoe West, Drummond, Coolcarrigan & Killinagh Lower & Killinagh Upper, Co. Kildare as described hereunder. The development will consist of an engineered landfill site (footprint 21.2 hectares (ha), comprising 8 no. phases, to accept up to 120,000 tonnes per annum of non-hazardous residual municipal waste for disposal; a composting facility with a capacity of 25,000 tonnes per annum; for an operational lifespan of 20 years. In addition to the waste acceptance period, permission is also sought for an additional 2 years to facilitate preliminary development works prior to waste acceptance and restoration of the site following cessation of waste acceptance. Permission is also sought for ancillary facilities including landscaping, provision of improved site entrance and access road (4,800 metres (m) from the R403 to the facility entrance, internal site haul roads (2,380m); clay borrow area (10ha) and sand & gravel borrow area (12.7ha) for the extraction of 212,300 cubic metres (cu m) of clay and 248,410 cu m of sand and gravel respectively, to be used for the construction of the proposed facility, composting building and biofilter (4,157 square metres (sqm); administration building (434sqm); parking (700sqm) for 17 no. cars, two delivery vans and one coach; 2 no. weighbridges (140sqm) and weighbridge reception kiosk (7.5sqm); maintenance facility (180sqm) bunded concrete hardstand for waste inspection and quarantine (585 sqm); bunded oil storage area (22.5sqm); on site water borehole; wheelwash (180sqm) surface water drainage system, oil interceptor and grit trap; 5 no. surface water settlement lagoons (total area 5.464sqm), 2 no. leachate holding tanks (combined capacity of 400cu m) and leachate pump sump at bunded concrete hardstand leachate management facility (1,000sq m); landfill gas collection compound and gas flare (35 sqm); security fencing and all other site development works above and below ground on a total site area of 139ha. An EIS accompanies this application – Bord Na Mona PLC – Planning Ref: 371/04

Dear Sir,

I refer to the above planning reference and to your submission received 8th February 2008.

Comhairle Chontae Chill Dara, Áras Chill Dara, Páirc Devoy, An Nás, Co. Chill Dara.
Kildare County Council, Áras Chill Dara, Devoy Park, Naas, Co. Kildare.
T 045 980200 • **F** 045 980240 • **E** secretar@kildarecoco.ie • www.kildare.ie/countycouncil

Comhairle Contae
Chill Dara
Kildare
County Council

Further to visits to the site on 7th and 11TH February 2008 we can confirm that the works identified in the Stage 3 Road Safety Audit (Document Ref : 3141-TR01-RSA Stage 3-A) have been closed out satisfactorily.

The internal road network serving the above facility including turning bays, junctions, parking, hardstandings, footpaths and the entrance to the facility from the R403 in my opinion have been provided in accordance with the requirements of An Bord Pleanala's condition no 15 for reference no. PL 09.212059

Please contact Deirdre Kemmy on 980774 in the Compliance Section if you have any further questions with regard to same.

D. Kemmy

G.Perry
Senior Executive Officer
Planning Department

Comhairle Chontae Chill Dara, Áras Chill Dara, Páirc Devoy, An Nás, Co. Chill Dara.
Kildare County Council, Áras Chill Dara, Devoy Park, Naas, Co. Kildare.
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