Project Name:
N52 Ardee Bypass Scheme Phase II, County Louth

Licence Reference No:
13E290

Townland Names:
Boharnamoe, County Louth

Site Type:
Boharnamoe 1: Burnt Mound

National Grid Reference:
293585/290585

ITM Coordinate:
693515/790599

Consultant:
Irish Archaeological Consultancy Ltd.

Excavation Director:
Fintan Walsh

Report Author:
Fintan Walsh

Type of Report
Stage (iv) Final Excavation Report

Status of Report:
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IAC Irish Archaeological Consultancy

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Anne Tubridy
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ABSTRACT

The following Stage (iv) final report describes the results of an archaeological excavation of Boharnamoe 1 (licence ref.: 13E290), which was located along the route of the N52 Ardee Bypass Scheme Phase II. The site at Boharnamoe 1 was discovered during advance archaeological testing undertaken in 2012 by Ross MacLeod and Patricia Long (Licence Ref.: 12E374).

Stage (iii) excavation work at Boharnamoe 1 was undertaken on the 3rd September 2013.

The Stage (iv) post-excavation and dissemination services included all post-excavation analyses, environmental, dating, illustrative, archival, etc. arising from the Stage (iii) on-site works the results of which are detailed in this report.

Boharnamoe 1 comprised a heavily truncated burnt mound surviving only as an oval trough with no associated burnt mound spread. A sample of alder charcoal from the basal fill of the trough has been dated to the early Bronze Age period (2334–2137 BC).

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1 INTRODUCTION

1.1 General

This final report presents the results of the Stage (iv) Post-Excavation and Dissemination Services at Boharnamoe 1 carried out in the townland of Boharnamoe, Co. Louth (Figures 1–5; Plates 1 and 2). This work was undertaken as part of an archaeological mitigation program completed under the Archaeological Consultancy Services Contract for the N52 Ardee Bypass Scheme Phase II. Archaeological fieldwork was directed by Fintan Walsh of Irish Archaeological Consultancy Ltd (IAC) under licence as issued by the DoAHG in consultation with the National Museum of Ireland (13E290). The work was undertaken on behalf of Louth County Council and it took place on the 3rd of September 2013.

The site at Boharnamoe 1 was discovered during advance archaeological testing undertaken in 2012 by Ross MacLeod and Patricia Long (Licence Ref.: 12E374).

The purpose of the Stage (iii) Excavation Services was to preserve-by-record through appropriate rescue excavation any significant archaeological features or deposits discovered by earlier investigations, so as to mitigate impacts on the archaeological remains that may be discovered within the footprint of the project.

The Stage (iv) Post-Excavation and Dissemination Services for Boharnamoe 1 included all post-excavation analyses, environmental, dating, illustrative, archival, etc. arising from the Stage (iii) on-site works the results of which are detailed in this report.

1.2 The Development

The proposed N52 Ardee Bypass Scheme is 4.5km long and aims to bypass the town of Ardee. The proposed route runs south-west from the N2 in Glebe townland, to the north of Ardee Town to join with the existing N52. The route passes through the townlands of Glebe, Mullanstown, Townparks, Boharnamoe, Ballygowan and Mandistown. The scheme traverses the county boundary between Louth and Meath to the east of the River Dee.

1.3 Topography & Site Description

Boharnamoe 1 was located within the land take for the proposed N52 Ardee Bypass c. 400m north of the current N52. The site was located within an undulating field on the northern slope of 'Silver Hill' at *c.* 28.3–29.6m OD. In terms of the National Grid Boharnamoe 1 was located at 293585/290585 and the ITM Coordinate is 693515/790599.

1.4 Previous Archaeological Investigation

1.4.1 Archaeological testing in 2002 and 2004 – IAC Ltd (Bailey 2003 and 2004; licence refs.: 02E1745 and ext)

In 2002 testing was undertaken along two route options (North and South) where they pass through a medieval, D-shaped enclosure that contains a cemetery (RMP LH014-043) in Mullanstown townland. The cemetery was identified and the results of this are discussed in detail in the testing report (13E287).

1.4.2 Testing in 2012 – Rubicon Heritage (McLeod and Long 2012a; 12E0373)

Further archaeological testing was carried out in Mullanstown in 2012 to investigate the potential for further burials associated with the isolated burial identified in 2002 by Bayley. Stage (i)k works (removal of topsoil near a known or suspected monument)

were carried out within an area measuring *c.* 5600m². Several features comprising ditches, were identified however no further burials were recorded. It was recommended that these features be fully resolved.

1.4.3 Testing in 2012 – Rubicon Heritage (McLeod and Long 2012b; 12E0374)

Standard Stage (i) testing was also undertaken along the proposed route in 12 areas in late 2012. Two areas of archaeological significance were identified at this time, both of which appeared to represent burnt mound activity. These sites, designated as Ballygowan 1 and Boharnamoe 1, were fully excavated by IAC in 2013 (13E289 and 13E290).

1.5 Excavation Methodology

Stage (iii) Excavation Services included:

- Application for any Stage (iii) licences/Ministerial Directions.
- Removal of any topsoil from around the site(s) and the careful management and storage of that topsoil.
- The removal of geotextile membranes from above any archaeological features that may have been placed there at end of Stage (i) Services.
- The temporary fencing off of the site(s).
- Excavation of all sites in accordance with Excavation Specifications and Method Statements and the agreed Environmental Remains Strategy
- All necessary on-site site illustration, photography, survey and recording to meet requirements as detailed in these Services Requirements
- Initial processing, flotation, sieving of all soil samples taken from the excavation and appropriate bagging of all extracted environmental samples in accordance with the Environmental Remains Strategy and Excavation Specifications.
- Initial artefact/find stabilisation and conservation
- Preparation of Stage (iii) Post-excavation Assessment Report(s) and the Stage (iii) Revised Environmental Remains Strategy document.

The Stage (iii) Excavation Specification for Boharnamoe 1 as agreed with the client called for the following work to be undertaken at the site:

The excavation area measured *c.* 303m² and topsoil was stripped at Boharnamoe 1 by mechanical excavator fitted with a toothless bucket under strict archaeological supervision.

All archaeological features revealed were cleaned by hand and excavated and recorded using customised field record sheets or 'context sheets', as well as supporting records in the form of registers or lists of drawings, photographs, and the excavation director's field diary. All archaeological features found were drawn to scale, photographed and OD levels taken. Comprehensive drawings were produced at appropriate scales.

Appropriate sampling, as per *Stage (iii) Environmental Remains Strategy*, was undertaken and will be processed as per *Stage (iii) Revised Environmental Remains Strategy*.

The excavation area and the locations of any features recorded within them were recorded by our qualified surveyors using GPS survey equipment and have been tied into the National Grid for the report illustrations.

1.6 Stage IV Methodology

All post excavation works were carried out in accordance with the relevant approvals and in consultation and agreement with the National Roads Authority (NRA) Project Archaeologist, the National Monuments Section of the DoAHG and the NMI. Where necessary licences to alter and export archaeological objects were sought from the NMI.

Dating of the samples from the site was carried out by means of AMS (Accelerator Mass Spectrometry) Radiocarbon Dating of identified and recommended wood samples. The calibrated radiocarbon date in this report is quoted to two-sigma (95% probability) level of confidence.

Final Report Date Ranges

The following date ranges for Irish prehistory and medieval periods are used for this final report (after Carlin et al. 2008).

Mesolithic: 7000–4000 BC
Neolithic: 4000–2500 BC
Early Bronze Age: 2500–1700 BC
Middle Bronze Age: 1700–1200 BC
Late Bronze Age: 1200–800 BC
Iron Age: 800 BC–AD 500
Early medieval period: AD 500–1100
Medieval period: AD 1100–1600
Post-medieval: AD 1600–1800

2 EXCAVATION RESULTS

2.1 Natural Geology

Contexts

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C2	N/A	N/A	N/A	N/A	Compact mottled orange/grey marl/clay.	Subsoil.

Finds: N/A

Interpretation

The natural subsoil consisted of a compacted grey marl/clay (Plate 1) which after exposure and weathering took on a shiny silver hue perhaps suggesting how 'Silver Hill' got its name. All of the subsequent archaeological activity on the site was either cut into this or sealed it.

2.2 The Burnt Mound

All that remained of the burnt mound at Boharnamoe 1 was the sub-soil cutting trough. Nothing of the overlying spread (if one existed) survived however burnt mound material had accumulated in small depressions at various points in the site and also filled two plough furrows aligned south-east–north-west downhill from the trough (Plates 5 and 6). These depressions and furrows were recorded on plan and photographed but warrant no further comment.

2.2.1 Trough C3

Contexts

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C3	N/A	2.6	2	0.48	Sub-rectangular. Irregular sides and base.	Cut of trough.
C4	C3	1.74	1.74	0.14	Black silty clay. Charcoal. Burnt stone.	Upper fill of C3.
C5	C3	2.39	2.39	0.40	Black/brown silty peat.	Secondary fill of C3.
C6	C3	1.73	1.73	0.33	Black/yellow clay. Charcoal. Burnt stone.	Primary fill of C3.

Finds: None

Interpretation

Trough C3 was the only archaeological feature at Boharnamoe 1 (Figure 3; Plates 2, 3 and 4). It was sub-rectangular in plan with steep sides at its southern end and gradual sides along its northern. The base was irregular but generally flat (28.58m OD at base). The primary fill (C6) was charcoal-rich and is likely to represent the material left in the trough after its final use-cycle (Figure 3; Plate 3). The secondary fill (C5) was a silty peat, indicative of washed-in soils after the abandonment of the trough. The upper fill (C4) is likely to originate from elements of an associated burnt mound deposit which could have been dragged into the trough by ploughing.

Analysis of the flot of samples of fills C4 and C6 revealed wood species including (in order of frequency) hazel, oak, willow, ash, birch, cherry-type, elm and alder and Maloideae spp. (Lyons, Appendix 2.1). The charcoal fragments recovered from Boharnamoe 1 represents the wood species used as fuel at the site (*ibid.*), fuel for the fires to heat the stones before depositing them in the water-filled trough.

A sample of alder charcoal (0.5g) from the basal fill of trough C3 returned an AMS result of 3793 ± 29 BP (UBA 24994). The two-sigma calibrated result for this was 2334–2137 BC (QUB, Appendix 2.2), suggesting that this burnt mound was in use in the early Bronze Age.

2.3 Topsoil

Contexts

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C1	N/A	N/A	N/A	0.38	Mid brown sandy clay.	Topsoil.

Finds: None

Interpretation

The topsoil sealed the trough and fills. It was consistent across the site. No finds were identified from the topsoil.

3 SYNTHYSIS

The synthesis presents the combined results of all of the archaeological analysis carried out at Boharnamoe 1, Co. Louth. This includes the analysis of the physical and archaeological landscape, the compilation of information gathered during research into the site type, date, and function, and the results of the excavation and specialist analysis of samples taken during the course of on-site works.

3.1 Landscape Setting

Boharnamoe 1 is located within the land-take for the proposed N52 Ardee Bypass *c.* 400m north of the existing N52 road. The site is located within an undulating field on the northern slope of 'Silver Hill' at *c.* 28.3–29.6m OD.

3.2 Archaeological Background

Prehistoric Period

Evidence for prehistoric activity in the environs of the proposed scheme is scarce with no Recorded Monuments and Places dating to this period within *c.* 1km. It is possible that some of the enclosures in the area (RMP LH017-001, LH014-032) may also date to this period although further investigation would be required to confirm this. The burnt mound at Ballygowan (13E289) was located *c.* 650m to the south-west. This site was dated to 2288–2056 BC and may have been contemporary with Boharnamoe 1.

A ringditch (RMP LH014-033) is recorded at Mullacloe *c.* 1.1km north of the proposed scheme. Several standing stones are also recorded in the general area with an example known at Dowdstown (RMP LH014-035) *c.* 2km to the north-east. These sites generally date to the Bronze Age however they are often reused in the Iron Age and later periods. The town of Ardee itself has yielded a few notable prehistoric finds including a stone axehead (NMI record only), a flint arrowhead (NMI 1942:534) of probable Neolithic date and a bronze spearhead and bridle pendant (NMI 1929:1356 and 1357) of Iron Age date. Various flint tools including scrapers and cores have been discovered in Townparks townland (NMI 1987:186–203).

Burnt mounds – a general introduction

Burnt mounds (also known as *fulacht fiadh)* are one of the most common field monuments found in the Irish landscape. Thousands have been excavated in recent years through development-led archaeological investigations. In spite of this, no clear understanding of the precise function of these sites has been forthcoming. Burnt mound sites are typically located in areas where there is a readily available water source, often in proximity to a river or stream or in places with a high water table. In the field, burnt mounds may be identified as charcoal-rich mounds or spreads of heat-shattered stones, however, in many cases the sites have been disturbed by later agricultural activity and are no longer visible on the field surface. Nevertheless even disturbed spreads of burnt mound material often preserve the underlying associated features, such as troughs, pits and gullies, intact.

Ó Néill (2003–2004, 82) has aptly identified these sites as the apparatus and by-product of pyrolithic technology. This technology involved the heating or boiling of water by placing fire-heated stones into troughs of water. Small shallow round-bottomed pits, generally referred to as pot boiler pits or roasting pits, are often associated with burnt mound sites. The purpose of these pits remains unclear. Occasionally large pits are also identified and may have acted as wells or cisterns. Linear gullies may extend across the site, often linked to troughs and pits, and demonstrate a concern with on-site water management. Post and stakeholes are

often found on burnt mound sites and these may represent the remains of small structures or wind breakers.

Burnt mound sites are principally Bronze Age monuments and reach their pinnacle of use in the Middle/Late Bronze Age (Brindley *et al*. 1989−90; Corlett 1997). Earlier sites, such as Enniscoffey Co. Westmeath (Grogan *et al*. 2007, 96), have been dated to the Neolithic and later sites, such as Peter Street, Co. Waterford (Walsh 1990, 47), have been dated to the medieval period. Thus, although burnt mound sites generally form a component of the Bronze Age landscape, the use of pyrolithic technology has a long history in Ireland.

Although there is a general consensus that burnt mound sites are the result of pyrolithic technology for the heating or boiling of water, the precise function of these sites has, to date, not been agreed upon. Several theories have been proposed but no single theory has received unanimous support. The most enduring theory is that burnt mounds sites were used as cooking sites. O'Kelly (1954) and Lawless (1990) have demonstrated how joints of meat could be efficiently cooked in a trough of boiling water. The use of burnt mound sites for bathing or as saunas has been suggested as an alternative function (Lucas 1965, Barfield and Hodder 1987, O' Drisceoil 1988). This proposal is largely influenced by references in the early Irish literature to sites of a similar character and is very difficult to prove, or disprove. Others, such as Jeffrey (1991), argue that they may have been centres of textile production for the fulling or dyeing of cloth. More recent demonstrations by Quinn and Moore (2007) have shown that troughs could have been used for brewing, however, this theory has been criticised by leading Irish environmentalists due to the absence of cereal remains from most burnt mound sites (McClatchie *et al*. 2007).

3.3 Summary of the Excavation Results

All that remained of the burnt mound at Boharnamoe 1 was the sub-soil cutting trough C3 (2.6m x 2m x 0.48m deep). Nothing of the overlying spread (if one existed) survived however burnt mound material had accumulated in small depressions at various points in the site and also filled two plough furrows aligned south-east–north-west downhill from the trough

3.4 Summary of the Specialist Analysis

Two specialists provided analysis of samples recovered from the site as part of the post-excavation works. This work in part formed the basis for the dating evidence for the site. The detailed reports on the results of all analysis are in Appendix 2.

Charcoal Analysis – Susan Lyons

Hazel and oak dominated the charcoal assemblage from the lower fill (C6) of the trough with lower incidences of willow, ash alder and cherry. In contrast, hazel was the dominant wood species recovered from the upper fill (C4). While lower occurrences of ash, willow, oak, and cherry were also identified, there was also evidence for birch and elm charcoal.

There was also evidence for wheat and barley from the trough.

Radiocarbon Dating

A sample of alder charcoal (0.5g) from the basal fill of trough C3 returned an AMS result of 3793 ± 29 BP (UBA 24994). The two-sigma calibrated result for this was 2334–2137 BC (QUB, Appendix 2.2), indicating a date in the early Bronze Age for this burnt mound.

4 DISCUSSION AND CONCLUSIONS

Boharnamoe 1 was a truncated burnt mound comprising only a large trough. The only other features on site comprised two plough furrows filled with burnt mound material. A sample of charcoal from the basal fill of the trough has been dated to the early Bronze Age period.

The nearest burnt mound site to this is at Ballygowan 1 *c.* 650m to the south-west (also excavated by IAC during this phase of works) and this site comprised a small trough with shallow associated spread. This was also dated to the early Bronze Age period. On the basis of the calibrated results from both sites (Illus. 1) there is every reason to believe that they could have been broadly contemporary.

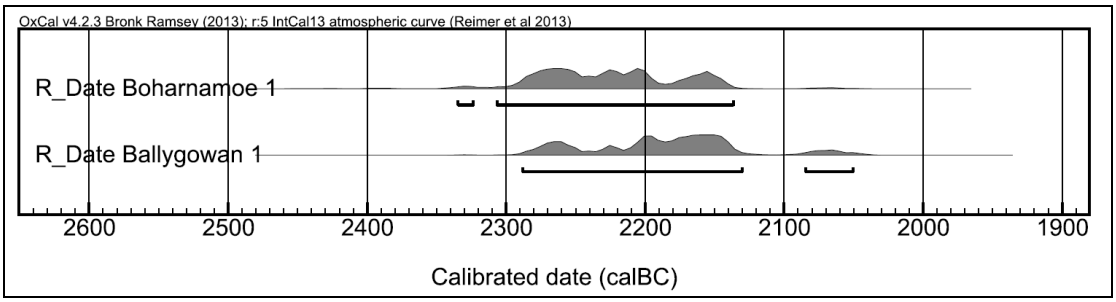

Illustration 1: Calibrated dates for Ballygowan 1 and Boharnamoe.

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Electronic Sources

www.excavations.ie – Summary of archaeological excavation from 1970–2008

www.archaeology.ie – DoAHG website listing all SMR sites with aerial photographs

www.osi.ie – Ordnance Survey aerial photographs (1995, 2000 & 2005) and historic OS mapping (first edition 6" and 25")

APPENDIX 1 CATALOGUE OF PRIMARY DATA

Appendix 1.1 Context Register

Context	Fill of	L(m)	W(m)	D(m)	Description	Interpretation
C1	N/A	N/A	N/A	0.38	Mid brown sandy, peaty clay.	Topsoil
C2	N/A	N/A	N/A	N/A	Very compacted mottled orange and grey gravely marl/clay.	Subsoil.
C3	N/A	2.6	2	0.48	Sub-rectangular/irregular in plan. Gradual break of slope at top. Irregular sloping sides. Gradual to sharp break of slope at base. Irregular/flat base.	Cut of trough.
C4	C3	1.74	1.74	0.14	Blackish brown silty clay with occasional charcoal flecks & occasional small burnt stones/pebbles.	Upper fill of C3.
C5	C3	2.39	2.39	0.40	Blackish brown silty peat containing occasional charcoal flecks & moderate small burnt stones/pebbles.	Secondary fill of C3.
C6	C3	1.73	1.73	0.33	Mottled black/yellow silt containing occasional charcoal flecks and frequent burnt stones.	Primary fill of C3.

Appendix 1.2 Catalogue of Artefacts

No artefacts were recovered from the site.

Appendix 1.3 Catalogue of Ecofacts

Sample No.	Context No.	Feature Type:	Charcoal and Seed	Animal Bone	Burnt Clay
1	C4	Upper fill of Trough C3	61.1g	None	None
2	C6	Primary fill of Trough C3	147.3g	None	None

Appendix 1.4 Archive Register

Project: N52 Ardee Bypass Scheme Phase II		
Site Name: Boharnamoe 1		
Licence Number: 13E290		
Site director: Fintan Walsh		
Date: October 2013		
Field Records	**Items (quantity)**	**Comments**
Site drawings (plans)	1	Digitised
Site sections, profiles, elevations	1	Digitised
Other plans, sketches, etc.	0	
Timber drawings	0	
Stone structural drawings	0	
Site diary/note books	1	
Site registers (folders)	1	
Survey/levels data (origin information)	Digital	Site survey
Context sheets	6	Digitised
Wood Sheets	0	
Skeleton Sheets	0	
Worked stone sheets	0	
Digital photographs	13	
Photographs (print)	0	
Photographs (slide)	0	
Security copy of archive	IAC Ltd	Digital archive

APPENDIX 2 SPECIALIST REPORTS

Appendix 2.1 Charcoal and Wood Report – Susan Lyons

Appendix 2.2 AMS Radiocarbon Dating Results – QUB Laboratory

Appendix 2.1 Charcoal and Wood Report – Susan Lyons

Plant Macrofossil & Charcoal Analysis Report

Scheme – N52 Ardee Bypass Scheme Phase II, Co. Louth:
Ballygowan 1 (13E289), Boharnamoe 1 (13E290), Mullanstown 1 (13E288)

Client – IAC Ltd.
Order No. – 283

Author- Susan Lyons MSc
Date –13/03/2014

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Non-technical Summary

This report details the final results of archaeobotanical remains (plant macrofossil and charcoal) recovered from soil samples associated with the archaeological excavations in advance of the N52 Ardee Bypass Scheme Phase II, Co. Louth. As part of the post-excavation strategy for the project, a total of ten samples from Ballygowan 1, Boharnamoe 1 and Mullanstown 1 were selected by Irish Archaeological Consultancy Ltd. and submitted to Susan Lyons for archaeobotanical and wood species analysis.

The Bronze Age activity along the N52 was characterized by burnt mound/*fulacht fiadh* identified at Ballygowan 1 and Boharnamoe 1. A mixed composition of hazel, alder, pomaceous fruitwoods, alder, willow, oak, ash, birch, elm and cherry were identified representing the variety of wood burnt as fuel at these sites. A trough at Boharnamoe 1 contained a single wheat and barley grain, most likely residual or re-deposited debris from nearby domestic activity.

Barley, oat and wheat grains were recorded from a medieval crop drying kiln (C14) at Mullanstown 1, evidence that arable agriculture was being practiced at the site. Barley was the crop of choice being dried, although oat and wheat were also present, which could reflect the drying of a maslin crop. The high frequency of cereal remains has been interpreted as either the remains of a localised firing event within the kiln itself or a build-up of residual crop debris from multiple drying events. The charcoal assemblage from Mullanstown 1 centred around three main features; curvilinear ditch (C5), crop drying kiln (C14) and charcoal production kiln (C20).While kiln C14 may have been fuelled using a mixture of hazel and willow wood, peat and wild plants, hazel and willow may have also formed part of the fabric of the kiln structure. The charcoal production kiln C20 contained predominantly oak charcoal, while open features, such as ditch C5 comprised a variety of wood species (oak, hazel, willow, pomaceous fruitwoods, birch, cherry, holly and elm) reflecting the range of woods that were being used at the site and potentially growing in the immediate area. Despite variation in the composition of wood species from the Bronze Age and early medieval sites, the charcoal assemblage revealed no distinctive shift in local woodland during this time. The only obvious exception was the absence of ash and alder from medieval deposits.

Statement of Significance

Analysis of archaeobotanical remains from archaeological excavations can provide a variety of insights into past societies and environments. The analysis of plant macrofossil remains, such as cereal remains, nutshell and wild taxa can provide information about diet, agriculture and local environments and help with interpreting functionality and changes in site activity. In addition, charcoal and wood analysis can provide valuable information into wood selection for particular uses, such as structural posts, firewood, pyre material fuel and wattle. This can offer insights into the cultural, ecological and economic significance of using local resources and changes to the use of these resources over time.

This type of analysis when integrated with other analyses and on-site archaeological interpretation can offer a more comprehensive and detailed account of site and feature functionality, changes to site use over time as well as providing a framework to allow for reconstructing local environmental conditions at a site.

1 Introduction

This report presents the results of archaeobotanical remains from soil samples associated with the archaeological excavations in advanced of the N52 Ardee Bypass Scheme Phase II, Co. Louth. Ten soil samples from three sites were analysed for the recovery of plant macrofossils and wood charcoal.

Site name	Licence number	No. of soil samples	Type of site
Ballygowan 1	13E289	1	Truncated burnt mound; including oval trough
Boharnamoe 1	13E290	2	Truncated burnt mound; including oval trough
Mullanstown 1	13E288	7	Ditches, kiln, pits and inhumation burial - possible peripheral features associated with nearby settlement cemetery (RMP LH014-043)

Archaeobotanical analysis is an important component of archaeological excavation and post-excavation works. These remains provide valuable information about explicit activities carried out at a site, including the function and nature of certain features, arable agriculture practices, site economy, diet, food processing and how local natural resources were exploited (Murphy and Whitehouse 2007; McClatchie 2007). Cereal grains, nutshells, seeds and fruit-stones represent the most commonly preserved non-wood plant macro-remains. Delicate chaff from arable crops is also frequently recovered. Other plant components can sometimes be preserved, including cereal bran, leaves, bud-scales and thorns. Vegetative tissues (parenchyma) from roots and tubers, which can be used in a range of activities, may also be recovered.

Woodland resources, including wood and charcoal, were of enormous importance in the past. Communities during both the prehistoric and historic periods were dependant on woodland resources for everyday living, including construction materials for buildings, manufacture of most implements, firewood and fuel (Kelly 1988; O'Donnell 2007; Stuijts 2007; O'Carroll 2011). Analysis of wood and charcoal remains can provide functional evidence for various activities at a site, as well as insights into cultural, ecological and economic variables. Certain wood species may have been selected for particular uses, such as structural posts, firewood, pyre material fuel and wattle. Charred remains also provide suitable material for the purpose of obtaining radiocarbon dates (C14 dating).

2 Radiocarbon dating

A total of seven radiocarbon dates were obtained from these excavations. The earliest recorded archaeological activity was from burnt mound activity at Ballygowan 1 and Boharnamoe 1 which dated to the early Bronze Age, while occupation activity from Mullanstown 1 dated to the early medieval period (Walsh 2013a-c) **Table 1.**

Site name	Context type	Material submitted for C14	UBA Lab Number	C14 Date BP	2 Sigma Calibration	Period
Ballygowan 1	Fill of trough C5	Hazel charcoal	UBA 24993	3768 ± 29	2288–2056 BC	Early Bronze Age
Boharnamoe 1	Fill of trough C6	Alder charcoal	UBA 24994	3793 ± 29	2334–2137 BC	Early Bronze Age
Mullanstown 1	Skeleton 1	Skeletal remains	UBA 24991	1495 ± 27	AD 437– 639	Early medieval period
	Kiln C14	Barley grain	UBA 24992	1451 ± 26	AD 566–649	
	Ditch C10	Unidentifiable bone	SUERC-44188	1578 ± 25	AD 442–543	
	Ditch C12	Unidentifiable bone	SUERC-44192	1410 ± 25	AD 601–662	
	Ditch C5	Carbonised nutshell	SUERC-44193	1567 ± 25	AD 425–550	

Table 1

3 Methodology

3.1 Soil sample processing (after IAC Ltd)

Bulk dry soil samples are [1]processed using a system of floatation by Irish Archaeological Consultancy Ltd (IAC Ltd). This is where each sample is soaked in water and agitated by hand to loosen any charred remains from the soil particles which allows for this material to be separated and float to the surface. This floating material (flot) is poured off and trapped in a sieve (mesh size 250 µm) and, once dried, scanned for plant remains using a binocular microscope. The larger residual material left behind (retent) is washed through a 1mm, 2mm and 5mm mesh or sieve and air-dried. Once dry, each retent is sorted by eye and any material of archaeological significance removed.

3.2 Plant macrofossil and charcoal selection

A total of ten soil samples from three sites were selected by Irish Archaeological Consultancy Ltd for plant macrofossil and charcoal identification analysis. These samples were submitted to Susan Lyons for identification and analysis to determine the archaeological significance of the assemblage and to select suitable carbonised remains for the purpose of radiocarbon dating.

3.2.1 Plant macrofossil identification analysis

All flot samples were viewed under a low powered binocular microscope (magnification x6 to x40). Where preservation allowed, the charred plant macro-remains were identified to species level and quantified numerically. In the case of very large samples, a sub-sample of a minimum of 500 individual constituents were randomly identified and removed. This methodology was applied to samples associated with corn drying kiln C14 at Mullanstown 1 (13E288). Four samples from corn drying kiln C14 (Samples 4, 5, 6, and 8) contained a large assemblage of carbonised archaeobotanical remains. To determine the quantity and diversity of plant macrofossil remains from these samples, a representative sub-sample of 500 constituents were randomly selected for species identification. This is in line with standard archaeological methods employed for archaeobotanical analysis in Ireland as discussed and agreed with members of the Irish Archaeobotanical Discussion Group and as outlined in the National Roads Authority New Palaeo-Environmental Guidelines (McClatchie et al, forthcoming).

Abraded grains which are fragmented and where the embryo ends are absent can be more difficult to quantify as being from one or more component. In this case, all archaeobotanical remains have been numerically quantified in line the National Roads Authority New Palaeo-Environmental Guidelines (McClatchie *et al,* forthcoming).

Plant species are made using reference to the author's seed collection and standard seed atlases and references; *Flora of the British Isles* (Clapham A R, Tutin T G, Warburg E F, 1957), *Zadenatlas der Nederlandsche Flora* (Beijerinck W.1976), *New Flora of the British Isles 2nd Edition* (Stace C, 1997) and *Digital Seed Atlas of the Netherlands* (Cappers R.T.J., R.M. Bekker and J.E.A. Jans, 2006).

3.2.2 Charcoal identification analysis

Due to the potential for a very high number of charcoal fragments from individual processed samples, a representative sub-sample of a minimum of 30 charcoal

[1] Soil samples are processed according to the standards and guidelines outlined in the Institute of Archaeologists of Ireland (IAI) 'Environmental Sampling Guidelines for Archaeologists', (IAI, 2006) and Palaeoethnobotany: Handbook of Procedures. 2nd edition, San Diego: Academic Press (Pearsall, D 2000)

fragments were randomly chosen from each sample for identification and analysis. This is the recommended number of charcoal fragments to be analysed from archaeological sites as detailed through research carried out by Dr Carol Keepax (1988) and more recently for Ireland by Dr Ellen O'Carroll (2012). For the purpose of this project, a sub-sample of 50 fragments was chosen from large samples, which is in line with the standard sub-sampling strategy for archaeological charcoal by the National Roads Authority New Palaeo-Environmental Guidelines (McClatchie *et al,* forthcoming).

Wood charcoal identifications were undertaken in accordance with Section 25 of the National Monuments Act, 1930, as amended by Section 20 of the National Monuments Amendment Act 1994, to alter an archaeological object. The wood species identifications were conducted under a binocular microscope using incident light and viewed at magnifications of 100x, 200x and 400x where applicable.

Wood species identifications are made using wood reference slides and wood keys devised by Franklin and Brazier (1961), Schweingruber (1978), Hather (2000) and the International Association of Wood Anatomists (IAWA) wood identification manuals and (www.lib.ncsu/edu/insidewood) by Wheeler, Bass and Gasson (1989).

4. Results by site

For the purpose of this report, the results for each site will be presented and discussed separately.

4.1 Ballygowan 1 (13E289)

Just one soil sample was analysed from Ballygowan 1.

Context no.	Sample no.	Flot weight (grams)	Context description
5	1	33.8 g	Charcoal rich basal fill of trough C4

Table 2

4.1.1 Charcoal remains

The charcoal identifications from Ballygowan 1 are presented in **Table 2** and **5.** The wood species recorded are presented in **Figure 1.**

Four wood species totalling 35 charcoal identifications were carried out from Sample 1. The majority of the charcoal assemblage contained very minute charcoal filaments which were difficult to fracture for wood species identification. The optimum number of identifications for a *fulacht fiadh*/burnt mound sample was reached, as stipulated in the new NRA guidelines for palaeo-environmental sampling (McClatchie *et al.,* forthcoming).

Hazel (*Corylus avellana*) is the dominant wood species recorded from trough C4 (C5). Lower occurrence of willow (*Salix* spp.), alder (*Alnus glutinosa*) and pomaceous fruitwoods (Maloideae spp.) were also identified. The pomaceous fruitwood group, which are made up of apple (*Malus* sp.), hawthorn (*Crataegus* sp.), pear (*Pyrus* sp.) and whitebeam/rowan/mountain ash (*Sorbus* sp.) are difficult to separate microscopically in the absence of bark, buds and leaves.

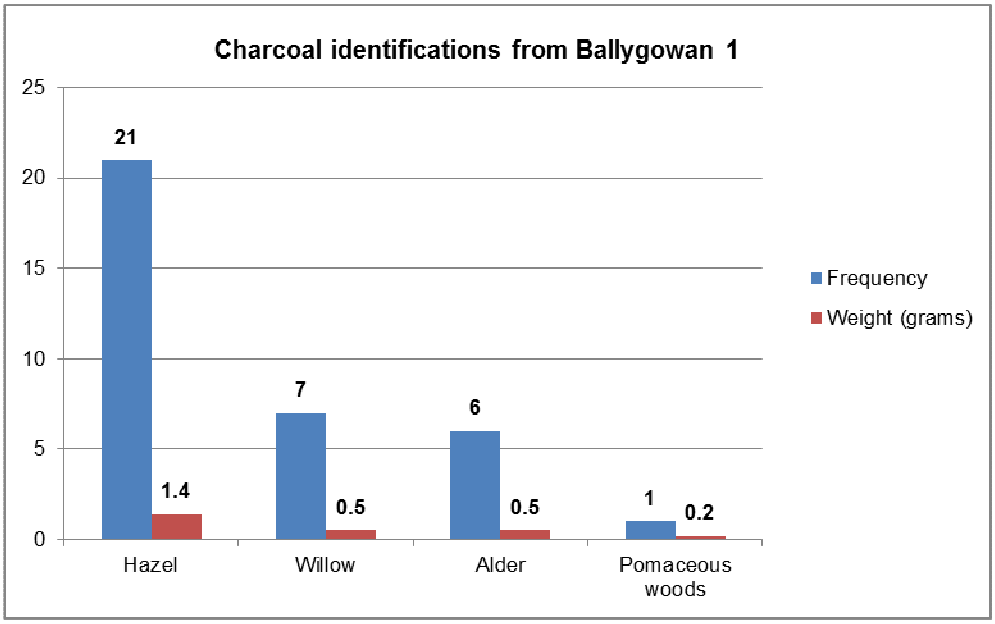

Fig. 1

4.1.2 Discussion

The wood species recorded from Ballygowan 1 are all native Irish species, with the exception perhaps of pear (*Pyrus* sp.) in the Maloideae group of wood. Despite the low number of identifiable charcoal fragments recovered from the samples these woods represent the species selected to be used as fuel at the site, which can help to understand what species potentially grew in the area. The charcoal assemblage identified from the trough was dominated by hazel, with lower incidences of willow, alder and pomaceous fruitwoods. These species are typically recorded at other Irish Bronze Age dated burnt mound/*fulacht fiadh* sites in Ireland (O'Donnell 2007, 42) and represents the mix of fuel used at the site. The nature of these sites required a constant supply of wood to burn as fuel and as such would have been located close to wooded areas. It has been hypothesised that wood used as firewood was collected from as close to a site as possible (Shackleton and Prins 1992) for ease of transport. Based on this paradigm, the amount of charcoal taxon within samples and ubiquity throughout these samples from a site are used as indicators of relative abundance in the local vegetation (Smart and Hoffman, 1987, 190). This therefore provides a basis to create a model for woodland reconstruction and patterns of woodland change. Hazel and pomaceous fruitwoods are common to peripheral or marginal woodland and may have colonised clearings close to the site. The water-tolerant alder and willow both frequently occur on such site types, since *fulachta fiadh* were usually located close to rivers or damp areas (Waddell 1998, 174).

An interesting observation is the absence of oak from Ballygowan 1, as oak was a prominent species from a similar site located in nearby Boharnamoe 1. Other wood species recorded from Boharnamoe, such as ash, elm, birch and cherry, were absent from Ballygowan, supporting the premise that the site at Ballygowan was potentially situated in a low-lying open area.

4.2 Boharnamoe 1 (13E290)

Two soil samples were analysed from Boharnamoe 1. The results of the plant macrofossil and charcoal analysis are presented in **Table 3** and **6**.

Context no.	Sample no.	Flot weight (grams)	Context description
4	1	61.1 g	Upper fill of trough C3
6	2	147.3 g	Primary fill of trough C3

Table 3

4.2.1 Plant macrofossil remains

The remains of just one wheat grain (*Triticum* spp.) and one barley grain (*Hordeum* spp.) were recovered from the primary fill of trough C3 (C6). The grains were abraded, suggesting they may have been re-deposited material or left exposed for some time.

4.2.2 Charcoal remains

Eight wood species totalling 99 identifications were recorded from trough C3 at Boharnamoe 1 **(Figure 2)**. Hazel (*Corylus avellana*) and oak (*Quercus* sp.) dominated the lower fill (C6), with lower incidences of willow (Salix spp.), ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*) and cherry (*Prunus* sp.) also present. In contrast, hazel was the dominant wood species recovered from the upper fill (C4). While lower occurrences of ash, willow, oak, and cherry were also identified, there was also evidence for birch (*Betula* sp.) and elm (*Ulmus* sp.) charcoal.

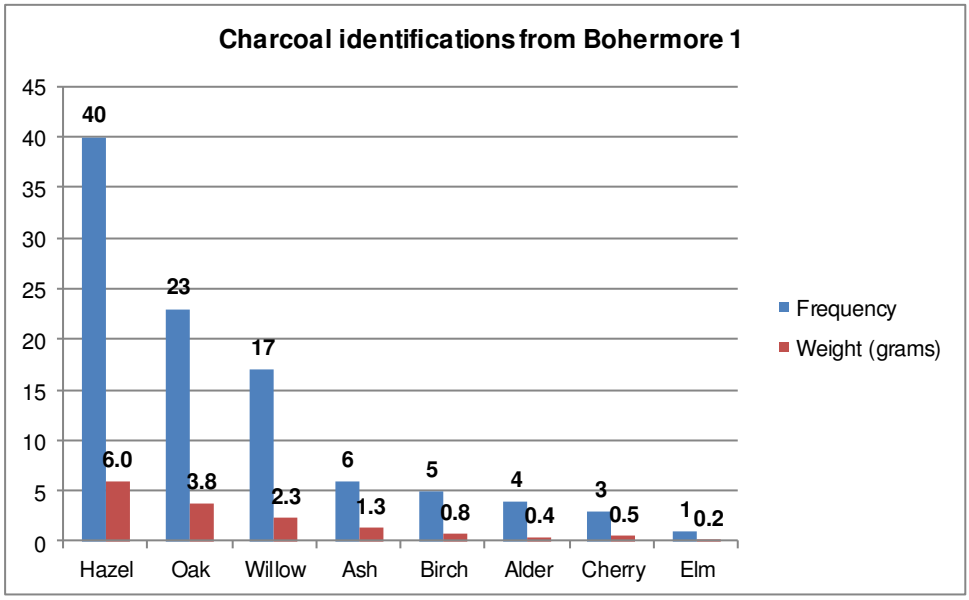

Fig. 2

4.2.3 Discussion

The presence of wheat and barley would not be unusual from a Bronze Age site, since both crops have been cultivated from the prehistoric period in Ireland (Monk 1986, 37; Johnston 2007, 71). The nature of these cereal grains from a *fulacht fiadh*/burnt mound site however is more difficult to interpret, since their presence here is more elusive. Plant remains (other than charcoal) are extremely rare from these sites (O'Neill 2000). To date approximately 8% of *fulachta fiadh* and their associated features from across Ireland have contained evidence for carbonised cereal grains which were recorded in very low quantities (< 5 grains/chaff fragments per site)

(McClatchie *et al* 2007). The grains analysed displayed no evidence for sprouting, suggesting that they were not charred during malting (brewing) practices (McClatchie *et al* 2007). The general perception based on current botanical evidence is that charred cereal remains are re-deposited material from other sources and may bear no relationship to the activities at the site find.

The wood species recorded from Boharnamoe 1 are all native Irish species and many were also recorded from a similar feature at nearby Ballygowan 1. The charcoal fragments recovered from Boharnamoe 1 represents the wood species used as fuel at the site. The preponderance of hazel and oak from trough C3 follows a similar trend recorded at other early Bronze Age dated burnt mound/*fulacht fiadh* sites in Ireland (O'Donnell 2007, 34). The use of hearths and fires at these sites would have required a constant supply of wood, hence the mix of other species recorded from these features (alder, willow, ash, cherry, elm and birch). The composition of wood species differed slightly between the upper fill (C4) and lower fill (C6) of trough C3. While this could just reflect the type of woods available in the locale and collected for fuel, it also provides a snapshot of the trees growing in nearby woodland. It has been hypothesised that wood used as firewood was collected from as close to a site as possible (Shackleton and Prins 1992) for ease of transport. The amount of charcoal taxon within a sample and the ubiquity throughout these samples are therefore used as indicators of relative abundance in the local vegetation (Smart and Hoffman 1987, 190). This can then provide a basis to create a model for woodland reconstruction and patterns of woodland change. Oak is common to well-drained upland areas and along with elm and ash, is indicative of areas where denser woodland exists. The presence of hazel and birch suggests pockets of clearings, perhaps close to marginal woodland, while cherry is common to open areas and hedgerows. Alder and willow are water-tolerant species and frequently occur on such site types, since *fulachta fiadh* were usually located close to rivers or damp areas (Waddell 1998, 174).

4.3 Mullanstown 1 (13E288)

A total of seven samples were analysed from Mullanstown 1.

Context no.	Sample no.	Flot weight (grams)	Context description
7	2	47.8 g	Fill of curvilinear ditch C5
18	4	87.4 g	Fill of cereal drying kiln chamber C14
19	8	32.4 g	Charcoal-rich fill of cereal drying kiln C14
21	9	3.6 g	Fill of charcoal production kiln C20
22	5	52 g	Layer of ash in cereal drying kiln C14
23	6	113 g	Ash/burnt clay/charcoal fill of cereal drying kiln C14
24	7	0.2 g	*In situ* burning in kiln chamber C14

Table 4

4.3.1 Plant macrofossil remains

The plant macro-remains from Mullanstown 1 are presented in **Tables 4**, **7** and **8**. The percentage of plant macrofossil remains recorded is presented in **Figure 3.**

Carbonised cereal remains

Carbonised cereal remains were recorded primarily from the cereal drying kiln C14 (C18, C19, C22, C23, C24) excavated at the site.

Barley (*Hordeum* sp.) was the dominant crop recorded accounting for 54% of the plant remains identified. Oat (*Avena* sp.) was the second most common species identified and made up 22% of the assemblage. It was difficult to ascertain if one or more oat species was present, in the absence of oat chaff (floret bases and palea and lemma). However, based on the size of the oat grain (caryopsis) and the absence of the large 'suckermouth'–type lemma bases it seems likely the common oat type (*A. sativa*) is the prominent species present in the assemblage. Just 2% of the cereal assemblage was wheat (*Triticum* sp.), tentatively identified as the bread/club variety (*T. aestivum/compactum*). The wheat grains were quite abraded and as such it was difficult to identify to species. A number of indeterminate grains were also recorded from the assemblage. These grains were too abraded to definitively identify and appear in the table as indeterminate grain (Cerealia).

A low incidence of cereal chaff in the form of culm nodes and rachis internodes were recorded from the kiln chamber (C18), kiln fill (C19) and an ash layer (C22). The culm nodes present could indicate that crops were cut low on the straw and brought to the site with the dried crop. This material was fragmented however and in the absence of key diagnostic features, further identified to genus or species level was prohibited. It is difficult to quantify chaff fragments as the exact intact elements are unknown and represent a multitude of cereal remains fragments.

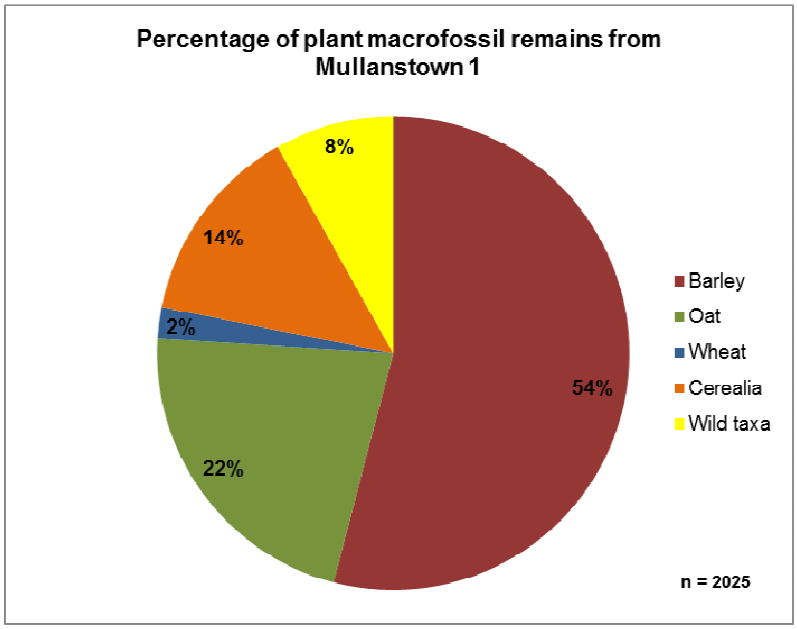

Fig. 3

Carbonised wild taxa

Wild taxa species made up 8% of the plant remains assemblage. They were recorded from deposits associated with the cereal drying kiln C14, most notably from an ash/burnt clay/charcoal layer (C23). For the most part, these remains were identified in features where carbonised cereal grains were also recorded. Plant species associated with disturbed and cultivated ground were commonly identified – fat hen (*Chenopodium album*), knotgrass (*Polygonum* sp.), smartweed (*Persicaria* spp.), redshank (*Persicaria lapathifolium),* sheep sorrel (*Rumex acetosella*) and dock (*Rumex* spp.). An unusually high number of black bindweed seeds (*Fallopia convolvulus)* were identified, particularly from deposit (C23), as were seeds from water smartweed (*Persicaria amphibium)*, an aquatic species common to wet ground, ponds and streams.

Burnt peat
Partial burnt peat was recorded from an ash layer in the fire-spot (C22) in kiln C14. The remains were too dried out and humified to recognise any plant macrofossil remains and is likely to be the remnants of fuel debris used in the kiln itself.

4.3.2 Charcoal remains
The charcoal identifications from Mullanstown 1 are presented in **Table 8**. The wood species recorded is presented in **Figure 4**.

Eight wood species totalling 103 identifications were recorded from Mullanstown 1. Hazel (*Corylus avellana*) was the dominant species recorded from ditch C5, with Lower incidences of pomaceous fruitwoods was also present in C5, along with birch (*Betula* spp.), willow (*Salix* spp.), holly (*Ilex aquifolium*), elm (*Ulmus* spp.), cherry (*Prunus* sp.) and oak (*Quercus* sp.). The pomaceous fruitwood group, which are made up of apple (Malus sp.), hawthorn (Crataegus sp.), pear (Pyrus sp.) and whitebeam/rowan/mountain ash (Sorbus sp.) are difficult to separate microscopically in the absence of bark, buds and leaves.

Oak was the main wood species identified from charcoal production kiln C20, with lower occurrences of birch and hazel charcoal. The quantity of charcoal from kiln C14 was relatively low, with willow and hazel charcoal recorded from kiln deposits C19 and C23 respectively. All fragments were relatively small in size, ranging from 5mm to 20mm in length. This suggests fragmentation as a result of extensive burning over time.

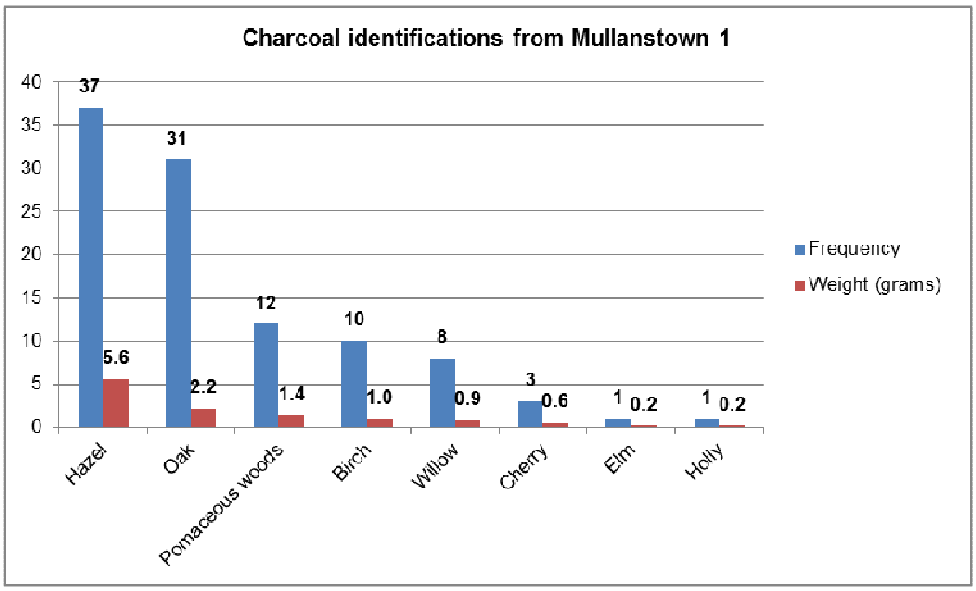

Fig. 4

4.3.3 Discussion
The only feature to contain evidence for charred cereal remains was the early medieval dated crop drying kiln C14. Cereal drying kilns were an integral part of the crop processing practice. During the medieval period, such kilns were constructed and used for a number of reasons (Scott 1951; Monk 1983):

- To dry the unthreshed crop prior to threshing
- To allow for the dehusking and removal of awns from hulled grain
- To harden the grain for grinding
- To kill the germinating grain after malting

• To improve the storage properties of the grain (killing pests and driving off excess moisture)

The regular use of fire as part of the cereal processing would have increased the risks of accidental burning occurring in these structures (Fenton, 1978, Evans, 1957, 123). This is likely to have occurred within kiln C14, as indicated by the volume of charred cereal remains recorded. The fact that the charred grain was left *in situ* implies that the kiln was not cleaned out, but instead reused, potentially on more than one occasion. The high barley grain content suggests it was the last crop dried. It is difficult to ascertain however whether the remains reflect one or more burning episodes. The presence of oat, barley and wheat in this context may also be incidental rather than contamination. Growing a mixed crop, known as dredge or maslin, was well documented in medieval England (Hallam 1981) and suggested by Geraghty (1997 49) for crop assemblages in Viking Dublin. Sowing mixed crops together had an economic incentive, since it ensured the probability of a decent yield as well as distributing seasonal labour requirements (Halstead and O'Shea 1989).

Much of the evidence regarding the arable economy of early medieval Ireland comes from the literary sources of that time. One such source, the eighth century law tract, *Bretha Déin Chécht*, discusses the importance of tillage farming and the social significance attached to the various cereals. Wheat was seen as a luxury crop associated with supreme kings and bishops; rye was the crop of lower ranking kings and poets, while barley and oat were the cereals of the graded farmers (Kelly, 1997, 219). Cereals were therefore regarded not just as a source of sustenance, but also as cultural symbols that could distinguish social classes (Fredengren *et al.* 2004).

Despite the literary evidence ecological factors must also have proved significant in crop cultivation. Wheat favours dry conditions and mineral-rich soils and may have been rarely grown in damper climates. In contrast to this, barley and oat are more versatile crops and can be cultivated on most soils (Monk *et al* 1998). This, together with the fact that barley and oat were used as both human and animal food, undoubtedly accounts for their higher frequency from many sites, as revealed by a national study of archaeobotanical remains conducted through the *Early Medieval Archaeology Project* (McClatchie *et al* 2011, 50). The predominance of barley and oat from Mullanstown 1 therefore fits the trend from other early medieval sites in Ireland. Interestingly, barley, which was the dominant crop at Mullanstown 1, is more common during the earlier period (4^{th} – 7^{th} century AD) in Ireland (McClatchie, *et al,* 2011, 57), which fits the early medieval dates for activity at Mullanstown 1 (5^{th} – 7^{th} century AD).

While the relatively low frequency of cereal chaff recorded from the grain assemblage suggests that the crop was cleaned prior to drying, the weed seed component is somewhat higher. Grains would require full processing (removal of chaff and weeds) prior to storage to prevent spoilage of the crop. In the event of a wet summer however, the grain can be stored as semi-cleaned spikelets (van der Veen 1989, 304). This would therefore account for chaff and weeds in a cereal assemblage. The majority of the weed seed assemblage however was identified from C23 (fire-spot deposit), which could indicate the remains of fuel rather than residual crop debris. A mixture of cereal chaff and weed seeds together with wood and peat, which was identified from C22 (fire-spot deposit), was commonly used as a fuel for parching grain (Hillman 1981) and may account for its presence in the kiln.

The charcoal assemblage from Mullanstown 1 centred around three main features; curvilinear ditch (C5), crop drying kiln (C14) and charcoal production kiln (C20). A diverse wood assemblage comprising hazel, willow, pomaceous fruitwoods, birch,

holly, cherry and elm was present from ditch C5. In the authors experience it is common for ditch fills to contain charcoal from multiple wood species. Charred debris from on-site burning activities would have entered these open features as dumped deposits or inadvertently as re-deposited material over time. Despite the high frequency of charred plant remains recorded from kiln C14, the charcoal assemblage was surprising low and confined to deposits C19 and C23. This suggests that while the drying crop may have caught fire within the kiln, the wooden superstructure of the kiln itself may not have been destroyed. Instead, the size and quantity of hazel and willow charcoal identified implies it is more likely the remains of fuel debris. The high oak charcoal recorded from charcoal production kiln C20 follows a similar trend recorded from other charcoal production features in Ireland, where oak was the prominent species used (Kenny 2010; O'Carroll 2012). When burnt, oak charcoal, particularly the dense heartwood, has higher calorific values than most European woods and this can make for good long-lasting fuel (Culter and Gale 2000). The presence of birch and hazel from C20 was much lower and may represent starter fuel debris or re-deposited woods from another source.

5. Local woodland

The charcoal recorded as part of this project has revealed a distinct use of specific wood species primarily for fuel and possible specialised activities, such as crop drying and charcoal production. Ballygowan, Boharnamoe and Mullanstown are all located close to each other, with activity dating from the early Bronze Age to the early medieval period recorded. Despite variation in the composition of wood species from the Bronze Age and early medieval sites, the charcoal assemblage reveals no distinctive shift in local woodland. The only obvious exception is the absence of ash and alder from medieval deposits, but the low charcoal counts must be a consideration when making any assumptions about the status of this species. The use of charcoal production pits at the site indicates that oak woodlands were still a prominent feature in the landscape in the medieval period, since it has been postulated that such activity would have been located close to a source of oak (Kenny 2010).

6. Conclusion

The Bronze Age activity along the N52 was characterized by burnt mound/*fulacht fiadh* identified at Ballygowan 1 and Boharnamoe 1. A mixed composition of hazel, alder, pomaceous fruitwoods, alder, willow, oak, ash, birch, elm and cherry were identified representing the variety of wood burnt as fuel at these sites. Evidence for wheat and barley from a trough at Boharnamoe 1 is most likely residual or re-deposited debris from nearby domestic activity.

The crop drying kiln at Mullanstown 1 is evidence that arable agriculture was being practiced at the site, where barley, oat and wheat were being cultivated.

The high frequency of cereal remains in contrast to the low charcoal content recorded from the kiln implies that the kiln may not have burnt down. Instead, the crop assemblage could represent either (a) a cache of burnt grain destroyed as a result of a minor firing episode within the kiln or (b) a build-up of residual crop debris from multiple drying events. Barley was the crop of choice being dried, although oat and wheat were also present, which could reflect the drying of a maslin crop. The kiln may have been fuelled using a mixture of hazel and willow wood, peat and wild plants. It must be remembered however that this plant assemblage represents just a snapshot of the grain destroyed and wood used during kilning activities and does not reflect earlier and later crop drying events at the site, so all interpretations are based

only on the plants that have survived. Specialised activities, such as charcoal production pits contained typically oak charcoal, while open features, such as ditches comprised a variety of wood species (oak, hazel, willow, pomaceous fruitwoods, birch, cherry, holly and elm) reflecting the range of woods that were being used at the site and potentially growing in the immediate area.

7. Recommendations for retention of environmental remains

Please see the relevant retention letter which accompanies this report. The recommendations presented are within current best practice standards for future palaeo-environmental analysis to take place. The National Museum of Ireland currently makes decisions relating to retention on a case-by-case basis.

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Table 5. Charcoal identifications from Ballygowan 1 (13E289)

Context no.	Sample no.	% of sample analysed	Flot/charcoal weight (grs)	Context Description	Wood Species	Frequency	Weight (grs)	Sample Comments
005	001	30%	33.8 grams	Charcoal rich basal fill of trough C4	Hazel (Corylus avellana)	21	1.4 g	The optimum number of charcoal fragments has been identified for this site. Majority of sample very minute filaments of charcoal too small for identification. Hazel charcoal fragment submitted for C14 dating
					Willow (Salix spp.)	7	0.5 g	
					Alder (Alnus glutinosa)	6	0.5 g	
					Maloideae spp. (pomaceous fruitwoods)	1	0.2 g	

Table 6. Composition of charcoal and plant macrofossil remains from Boharnamoe 1 (13E290)

Context no.	Sample no.	% of sample analysed	Flot/charcoal weight (grs)	Context Description	Charred plant macro remains	Frequency	Wood Species	Frequency	Weight (grs)	Sample Comments
004	001	100%	61.1 grams	Upper fill of trough C3	-	-	Hazel (Corylus avellana)	25	3.8 g	Sub-sample of charcoal identified
							Willow (Salix spp.)	8	1 g	
							Oak (Quercus sp.)	8	1 g	
							Birch (Betula sp.)	5	0.8 g	
							Cherry-type (Prunus sp.)	2	0.3 g	
							Elm (Ulmus spp.)	1	0.2 g	
							Ash (Fraxinus excelsior)	1	0.1 g	
006	002	100%	147.3 grams	Primary fill of trough C3	Wheat grain (Triticum spp.)	1	Oak (Quercus sp.)	15	2.8 g	Charred wheat grain (x1) and alder charcoal fragment submitted for C14 dating
							Hazel (Corylus avellana)	15	2.2 g	
							Willow (Salix spp.)	9	1.3 g	
					Barley grain (Hordeum spp.)	1	Ash (Fraxinus excelsior)	5	1.2 g	
							Alder (Alnus glutinosa)	4	0.4 g	
							Cherry-type (Prunus sp.)	1	0.2 g	

Table 7. Composition of plant macrofossil remains from Mullanstown 1 (13E288)

	Feature type	**Ditch**	**Charcoal production kiln**	**Cereal drying kiln**					**Totals**
	Context number	005	020	014	014	014	014	014	
	Fill number	007	021	018	019	022	023	024	
	Sample number	002	009	004	008	005	006	007	
	Flot weight (grams)	47.8 grs	3.6 grs	87.4 grs	32.4 grs	52 grs	113 grs	0.2 grs	
	% of Sample analysed	100%	100%	20%	25%	25%	25%	100%	
Latin name	***Common name***								
CEREALS: CARBONISED									
Hordeum vulgare L.	hulled barley	-	-	-	-	-	-	-	**-**
Hordeum spp.	barley	-	-	331	316	239	206	3	**1095**
Avena spp.	oat	-	-	119	72	156	97	-	**444**
Triticum spp.	wheat	-	-	11	23	5	4	-	**43**
Secale cereale L.	rye	-	-	-	-	-	-	-	**-**
Cerealia	indeterminate cereal grain/fragmented remains	-	-	39	89	100	193	9	**430**
Total cereal counts				***500***	***500***	***500***	***500***	***12***	***2012***
CEREAL CHAFF: CARBONISED									
Culm nodes	indeterminate fragments	-	-	3	-	-	-	-	**3**
Rachis internode	indeterminate fragments	-	-	-	3	2	-	-	**5**
Glume base	indeterminate fragments	-	-	-	-	-	-	-	**-**
WILD TAXA: CARBONISED									
Chenopodium album L.	fat hen	-	-	-	-	-	3	-	**3**
Polygonum spp.	knotgrass	-	-	-	10	-	3	-	**13**
Fallopia convolvulus (L.) Á Löve	black bindweed	-	-	39	-	11	51	-	**101**
Persicaria lapathifolium L.	redshank	-	-	-	-	-	6	-	**6**
Persicaria amphibia (L.) Gray	water smartweed	-	-	-	4	1	18	-	**23**
Persicaria spp.	smartweed	-	-	-	-	-	4	-	**4**
Rumex cf acetosella L.	sheep's sorrel	-	-	-	-	3	8	-	**11**
Rumex spp.	docks	-	-	-	2	-	-	2	**4**
Total seed/fruit counts									***173***
OTHER PLANT REMAINS: CARBONISED									
Burnt peat	Unidentified	-	-	-	-	0.2 grs	-	-	**0.2 grs**
Total		***-***	***-***	***541***	***519***	***517***	***593***	***14***	***2185***

Table 8. Charcoal identifications from Mullanstown 1 (13E288)

Context no.	Sample no.	% of sample analysed	Flot/charcoal weight (grs)	Context Description	Wood Species	Frequency	Weight (grs)	Sample Comments
007	002	100%	47.8 grams	Fill of curvilinear ditch C5	Hazel (Corylus avellana)	24	4.1 g	Sub-sample of charcoal identified
					Maloideae spp. (pomaceous fruitwoods)	12	1.4 g	
					Birch (Betula spp.)	7	0.8 g	
					Cherry-type (Prunus sp.)	3	0.6 g	
					Willow (Salix spp.)	1	0.1 g	
					Oak (Quercus sp.)	1	0.2 g	
					Holly (Ilex aquifolium)	1	0.2 g	
					Elm (Ulmus spp.)	1	0.2 g	
018	004	20%	87.4 grams	Fill of cereal drying kiln chamber C14	-	-	-	No charcoal identified
019	008	25%	32.4 grams	Charcoal-rich fill of cereal drying kiln C14	Willow (Salix spp.)	7	0.8 g	
021	009	100%	3.6 grams	Fill of charcoal production kiln C20	Oak (Quercus sp.)	30	2 g	
					Birch (Betula spp.)	3	0.2 g	
					Hazel (Corylus avellana)	2	0.3 g	
022	005	25%	52 grams	Layer of ash in cereal drying kiln C14	-	-	-	Burnt peat remains noted
023	006	25%	113 grams	Ash/burnt clay/charcoal fill of cereal drying kiln C14	Hazel (Corylus avellana)	11	1.2 g	
024	007	100%	0.2 grams	*In situ* burning in kiln chamber C14	-	-	-	No charcoal identified

Susan Lyons MSc MIAI
Environmental Archaeologist

Irish Antiquities Division
National Museum of Ireland
Kildare Street
Dublin 2

18th June 2014

RE: Retention of Archaeobotanical & Charcoal Remains

Scheme: N52 Ardee Bypass Scheme Phase II, Co. Louth
Sites: Ballygowan 1 (13E289), Boharnamoe 1 (13E290), Mullanstown 1 (13E288)

To whom it may concern,

I am writing to you on behalf of *Irish Archaeological Consultancy Ltd* (IAC Ltd.) in relation to retaining the carbonised ecofacts from archaeological excavations associated with archaeological resolution at Ballygowan 1 (13E289), Boharnamoe 1 (13E290), Mullanstown 1 (13E288), along the N52 Ardee Bypass Scheme Phase II, Co. Louth.

Sample Strategy
As part of the post-excavation works for the project a total of 10 processed flot samples were selected for archaeobotanical (plant remains) and charcoal analysis **(Table 1).**

Analysis and Identification
Each dry flot was fully sorted by archaeobotanist Susan Lyons using a stereo microscope (Nikon SMZ 645) and any carbonized archaeobotanical material (plant macrofossil and charcoal) of archaeological significance was removed and recorded.

Charcoal samples which contained a high volume of plant macrofossil remains and charcoal were sub-sampled to obtain a representative collection of wood species. This is in line with current methodologies practices for sampling palaeo-environmental remains as outlined by the *NRA Palaeo-Environmental Sampling Guidelines Retrieval, analysis and reporting of plant macro-remains, wood, charcoal, insects and*

pollen and insects from archaeological excavations. National Roads Authority. Dublin (McClatchie, M., O'Carroll, E., and Murphy E. forthcoming).

All plant remains were placed in glass vials with sealable plastic lids and all identifiable charcoal remains were bagged in sealable plastic sample bags and labelled accordingly.

The results of the archaeobotancial and charcoal analysis from the N52 Ardee Bypass Scheme Phase II, Co. Louth have been recorded in a specialist report produced for the scheme (A copy of the specialist report should accompany this document).

Site	Licence	Context no.	Sample no.	% of sample analysed	Flot/charcoal weight (grams)	Context Description
Ballygowan 1	13E289	005	001	30%	33.8 grams	Charcoal rich basal fill of trough C4
Boharnamoe 1	13E290	004	001	100%	61.1 grams	Upper fill of trough C3
		006	002	100%	147.3 grams	Primary fill of trough C3
Mullanstown 1	13E288	007	002	100%	47.8 grams	Fill of curvilinear ditch C5
		018	004	20%	87.4 grams	Fill of cereal drying kiln chamber C14
		019	008	25%	32.4 grams	Charcoal-rich fill of cereal drying kiln C14
		021	009	100%	3.6 grams	Fill of charcoal production kiln C20
		022	005	25%	52 grams	Layer of ash in cereal drying kiln C14
		023	006	25%	113 grams	Ash/burnt clay/charcoal fill of cereal drying kiln C14
		024	007	100%	0.2 grams	*In situ* burning in kiln chamber C14

Table 1

Proposed retention

- It is recommended that the sorted archaeobotanical remains and charcoal from the 10 flots be retained by the National Museum of Ireland for long-term archive.
- In addition, four flot samples from a corn drying kiln (Context 14) recorded from Mullanstown 1 (13E288) should also be retained – Samples 4, 5, 6 and 8. Due to a high volume of carbonised plant macrofossil remains present these samples were sub-sampled to provide a representative quantity of the plant assemblage present. The retention of these flots will enable further analysis of archaeobotanical remains for:

- Future analysis into early medieval arable agriculture, for example crop drying kiln research in Ireland
- Further analysis of barley, wheat and oat species for the purpose of future research such as crop genetic
- Future radiocarbon dating strategies

- The flot associated with Sample 1 should be retained to enable future charcoal analysis
- The ecofacts removed are all carbonized dry material. Carbonized plant remains are essentially fossilized remains and as such are in a stable condition, which require no further conservation. The remains have also been sorted by species and are packaged in appropriate containers/bags for long-term storage.

Disposal

The following flot samples can be discarded as they have been sorted and all materials of archaeological significance removed **(Table 2).** In the case of Sample 1 from Ballygowan 1 (13E289) which was sub-sampled for charcoal identification analysis, the optimum number of charcoal fragments as outlined by the new NRA guidelines for palaeo-environmental sampling has been analysed.

Site	Licence	Context no.	Sample no.	% of sample analysed	Flot/charcoal weight (grams)	Context Description
Ballygowan 1	13E289	005	001	30%	33.8 grams	Charcoal rich basal fill of trough C4
Boharnamoe 1	13E290	004	001	100%	61.1 grams	Upper fill of trough C3
		006	002	100%	147.3 grams	Primary fill of trough C3
Mullanstown 1	13E288	007	002	100%	47.8 grams	Fill of curvilinear ditch C5
		021	009	100%	3.6 grams	Fill of charcoal production kiln C20
		024	007	100%	0.2 grams	*In situ* burning in kiln chamber C14

Table 2

Please contact me if you require any further information or clarification on the above.

Yours faithfully,

Susan Lyons

Susan Lyons\

Appendix 2.2 AMS Radiocarbon Dating Results – QUB Laboratory

The "Measured radiocarbon age" is quoted in conventional years BP (before AD 1950). The error is expressed at the one-sigma level of confidence.

The "Calibrated date range" is equivalent to the probable calendrical age of the sample material and is expressed at the one Sigma (68.3% probability) and two-Sigma (95.4% probability) level of confidence.

Calibration dataset: intcal13.14c

Calibration programme: CALIB REV7.0.0 (Copyright 1986-2013 M Stuiver and PJ Reimer)

Context	Sample No	Material	Species id/ Weight	Lab	Lab Code	Date Type	Calibrated date ranges	Measured radiocarbon age (BP)
C6	2	Charcoal	Alder (*Alnus glutinosa*), 0.5g	UBA	UBA 24994	AMS (Std)	2285–2150 BC (1 sigma), 2334–2137 BC (2 sigma)	3793 ± 29

QUB Certificate

Colette Rynhart
Irish Archaeological Consultancy Ltd
120b Greenpark Road
Bray
Co. Wiklow, Ireland
Rep. of Ireland
VAT No. IE8288812U

^{14}CHRONO Centre
Queens University Belfast
42 Fitzwilliam Street
Belfast BT9 6AX
Northern Ireland

Radiocarbon Date Certificate

Laboratory Identification:	UBA-24994
Date of Measurement:	2014-02-11
Site:	13E290 Bohernamoe 1
Sample ID:	C6 S2
Material Dated:	charcoal
Pretreatment:	AAA
Submitted by:	IAC

Conventional ^{14}C Age:	3793±29 BP
Fraction corrected	using AMS δ^{13}C

Information about radiocarbon calibration

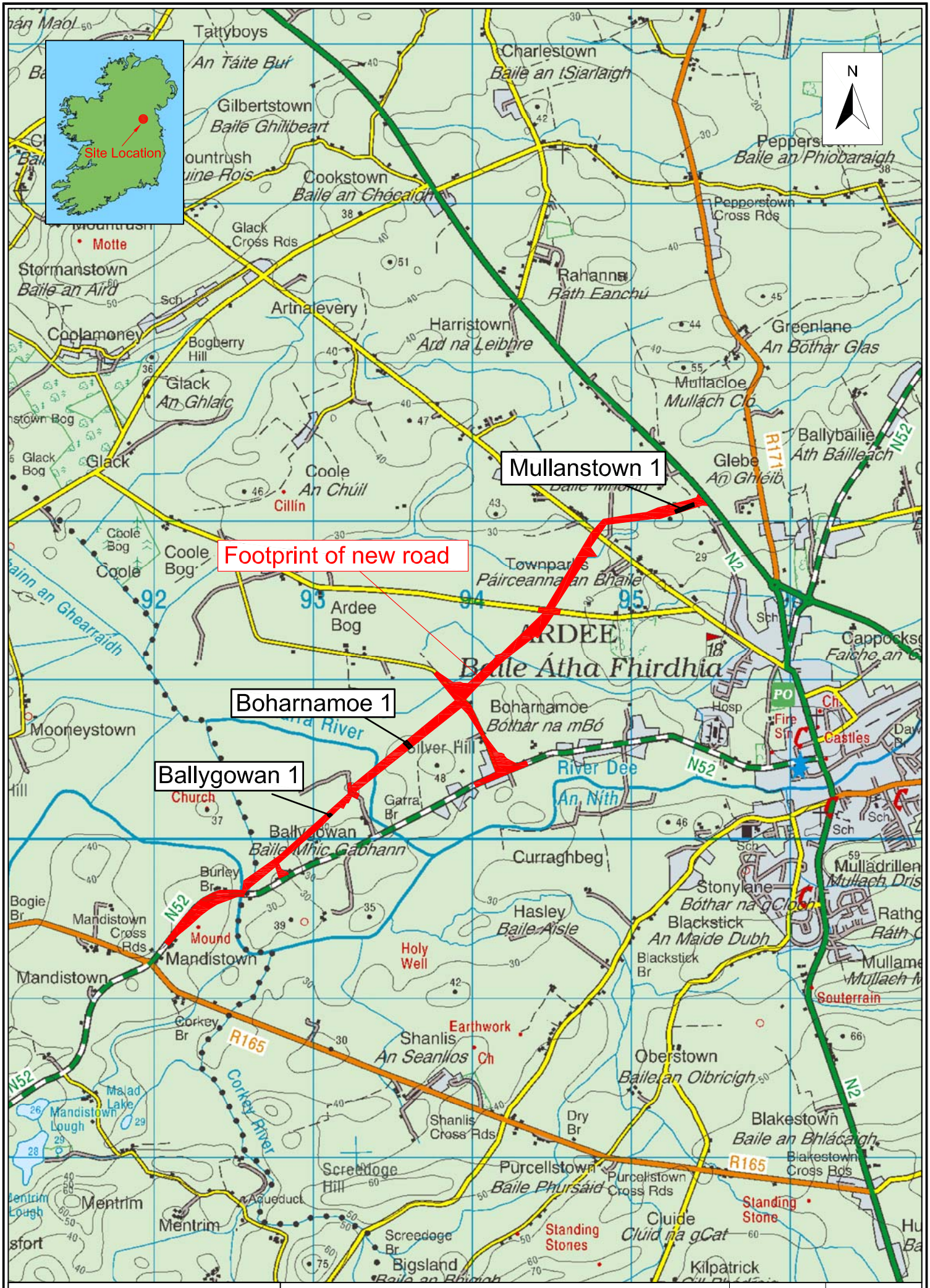
```
RADIOCARBON CALIBRATION PROGRAM*
CALIB REV7.0.0
Copyright 1986-2013 M Stuiver and PJ Reimer
*To be used in conjunction with:
Stuiver, M., and Reimer, P.J., 1993, Radiocarbon, 35, 215-230.
Annotated results (text) - -
Export file - c14res.csv
```

```
C6 S2
UBA-24994
Radiocarbon Age BP   3793 +/-   29
Calibration data set: intcal13.14c                # Reimer et al. 2013
  % area enclosed       cal AD age ranges           relative area under
                                                  probability distribution
  68.3 (1 sigma)     cal BC 2285- 2247                    0.441
                            2235- 2197                    0.405
                            2166- 2150                    0.154
  95.4 (2 sigma)     cal BC 2334- 2325                    0.011
                            2306- 2137                    0.989
```

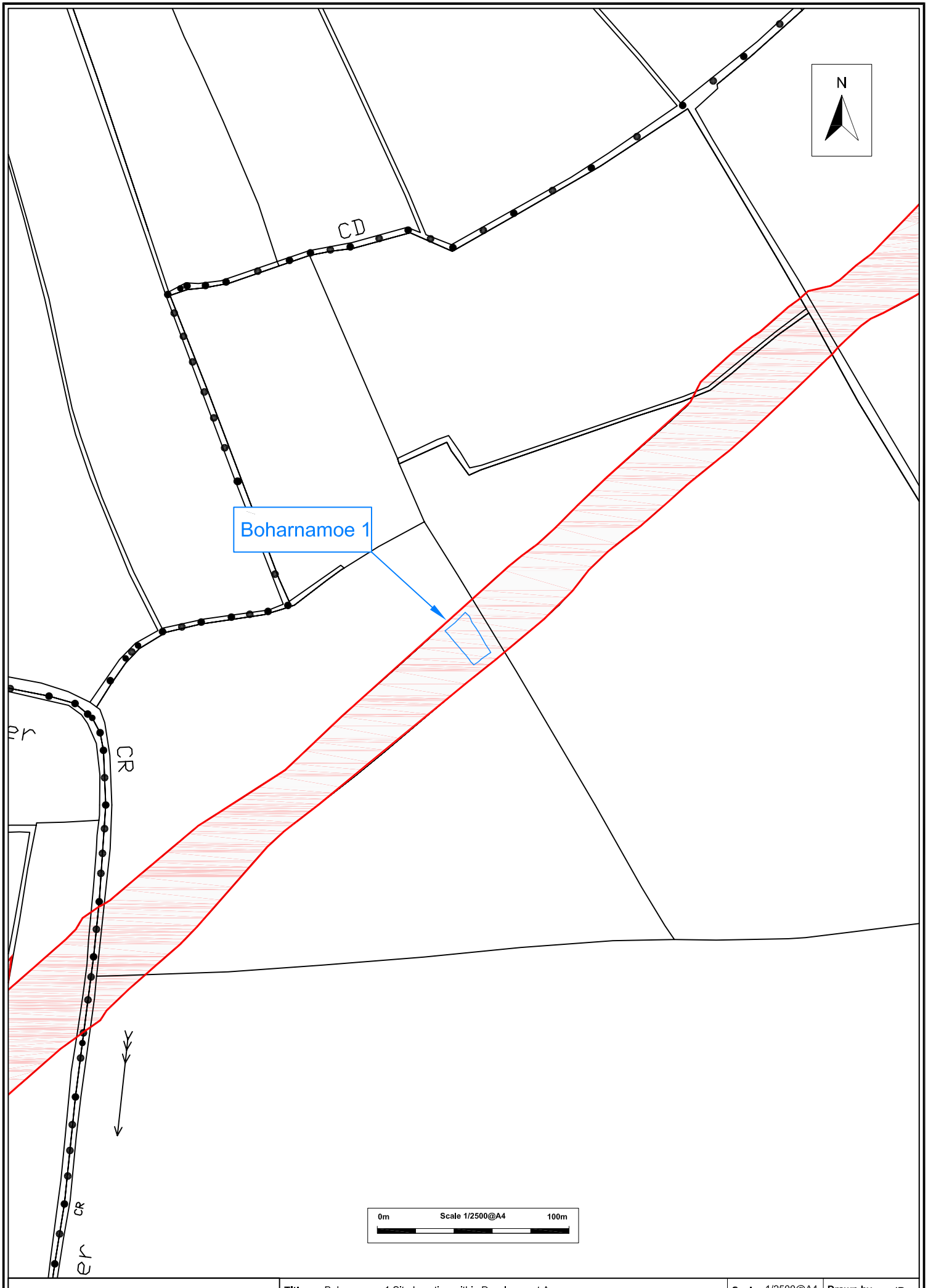
```
References for calibration datasets:
Reimer PJ, Bard E, Bayliss A, Beck JW, Blackwell PG, Bronk Ramsey C, Buck CE
Cheng H, Edwards RL, Friedrich M, Grootes PM, Guilderson TP, Haflidason H,
Hajdas I, HattÃ© C, Heaton TJ, Hogg AG, Hughen KA, Kaiser KF, Kromer B,
Manning SW, Niu M, Reimer RW, Richards DA, Scott EM, Southon JR, Turney CSM,
van der Plicht J.
IntCal13 and MARINE13 radiocarbon age calibration curves 0-50000 years calBP
Radiocarbon 55(4). DOI: 10.2458/azu_js_rc.55.16947

Comments:
* This standard deviation (error) includes a lab error multiplier.
** 1 sigma = square root of (sample std. dev.^2 + curve std. dev.^2)
** 2 sigma = 2 x square root of (sample std. dev.^2 + curve std. dev.^2)
where ^2 = quantity squared.
[ ] = calibrated range impinges on end of calibration data set
0* represents a "negative" age BP
1955* or 1960* denote influence of nuclear testing C-14

NOTE:  Cal ages and ranges are rounded to the nearest year which
       may be too precise in many instances.  Users are advised to
       round results to the nearest 10 yr for samples with standard
       deviation in the radiocarbon age greater than 50 yr.
```

APPENDIX 3 NRA DATABASE SHEET

Database entry	Comment
Excavation number	13E290
Townland	Boharnamoe
Site name	Boharnamoe 1
County	Louth
Project reference	N/A
Year of excavation	2013
Grid reference (Easting)	293585
Grid reference (Northing)	290585
OD Height (m)	*c.* 28.3–29.6m OD
Landscape setting	Boharnamoe 1 was located within the-land take for the proposed N52 Ardee Bypass *c*. 400m north of the current N52. The site was located within an undulating field on the northern slope of 'Silver Hill'.
Project Archaeologist	Niall Roycroft
Site Director	Fintan Walsh
Archaeological consultancy	IAC Ltd
Identification technique	Test Trenching
Site type	Burnt Mound
Site activity	Burnt mound activity
Dating period	Early Bronze Age
Radiocarbon dates	UBA 24994, alder charcoal, Basal fill of *fulacht* trough C3, 3793±29 BP, Cal. 2334–2137 BC (2 sigma).
Dendro-chronological dates	None
Descriptions	All that remained of the burnt mound at Boharnamoe 1 was the sub-soil cutting trough. Nothing of the overlying spread (if one existed) survived however burnt mound material had accumulated in small depressions at various points in the site and also filled two plough furrows aligned south-east–north-west downhill from the trough
Artefacts	N/A
Environmental evidence	*Charcoal and Ecofact Analysis:* A mixed composition of hazel, alder, pomaceous woods, alder, willow, oak, ash, birch, elm and cherry were identified representing the variety of wood burnt as fuel. Evidence for wheat and barley from a trough is most likely residual or re-deposited debris from nearby domestic activity.
Additional information	N/A
Publication	To be agreed with client.

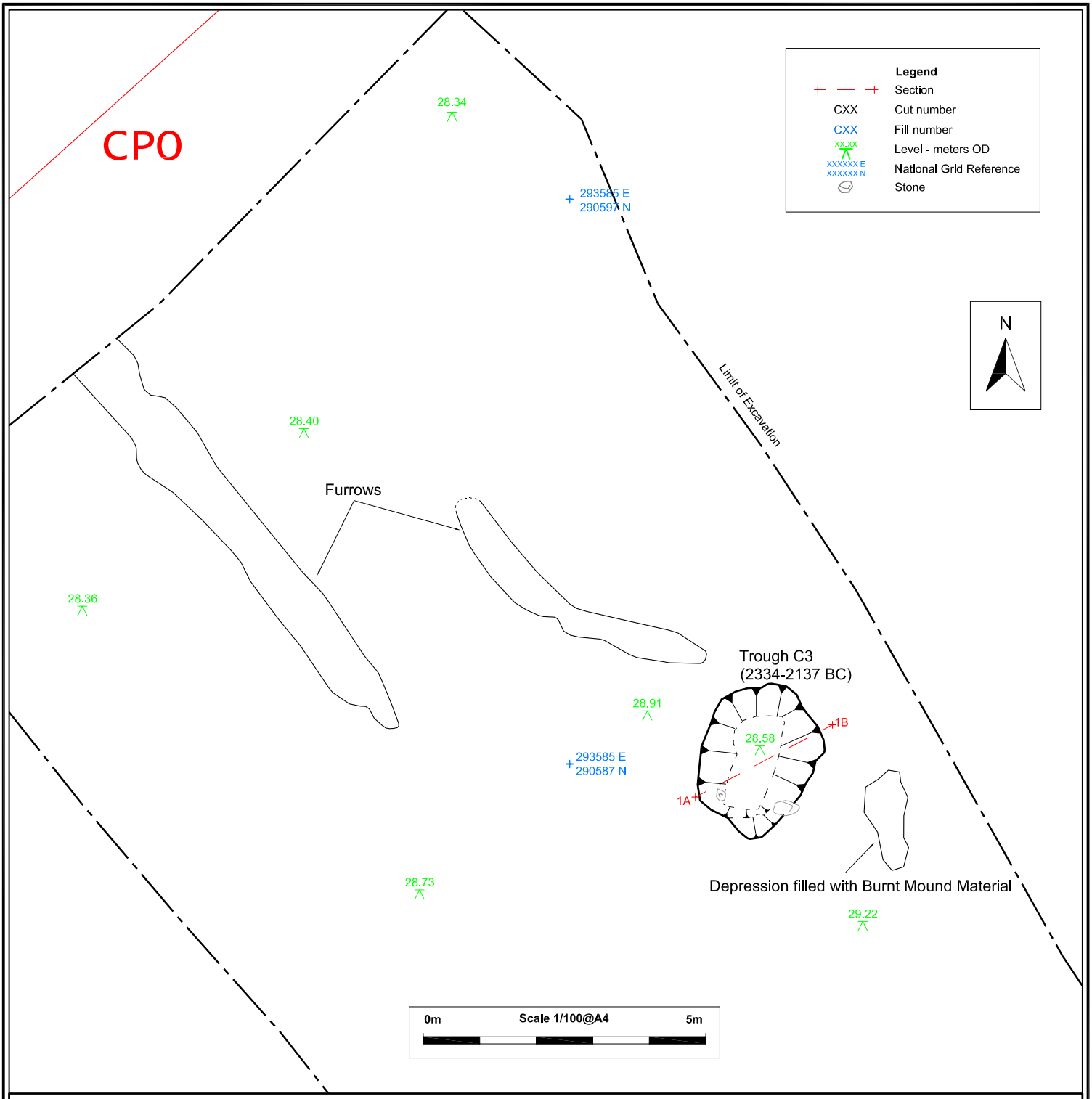


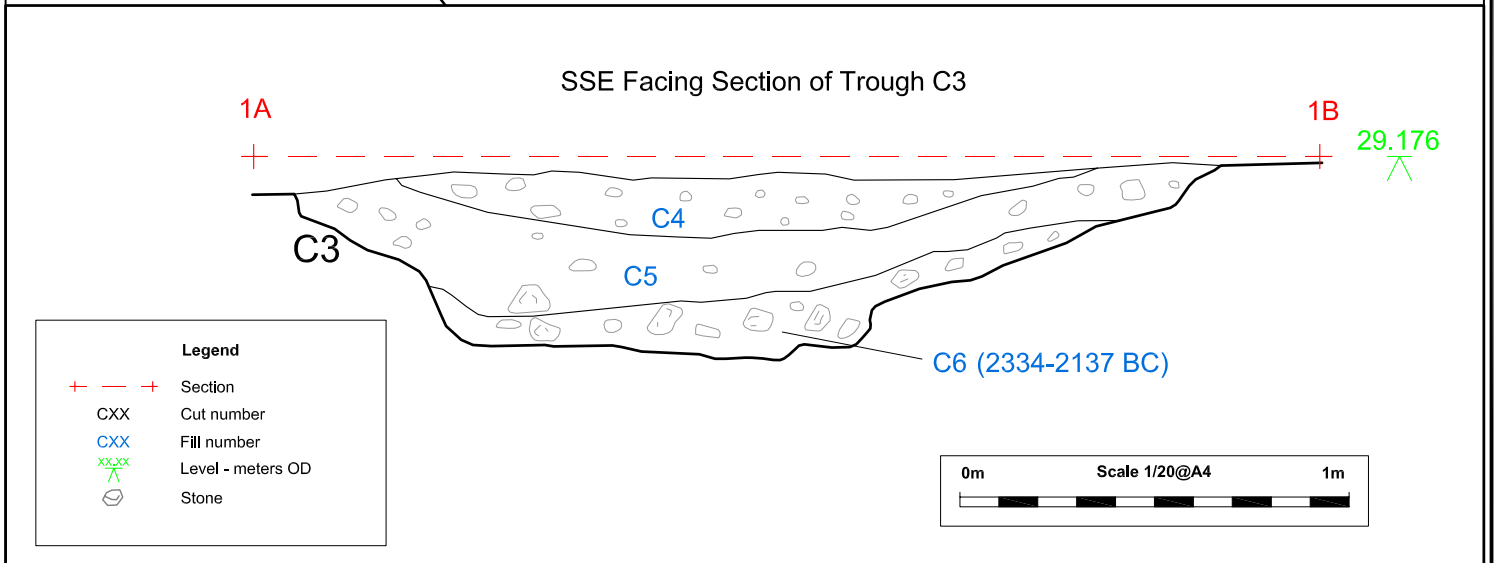
IAC Irish Archaeological Consultancy	**Title** Boharnamoe 1 Site Location		**Scale** N/A	**Drawn by** JR	
	Project N52 Ardee Bypass Scheme Phase II, Co. Louth		**Date** 29/07/2014	**Checked by** FW	
	Client Louth County Council		**Job no.** J2787	**Fig.** 1	**Rev.** 2



IAC Irish Archaeological Consultancy

Title	Boharnamoe 1 Site Location within Development Area	**Scale**	1/2500@A4	**Drawn by**	JR
Project	N52 Ardee Bypass Scheme Phase II, Co. Louth	**Date**	23/04/2014	**Checked by**	FW
Client	Louth County Council	**Job no.**	J2787	**Fig.** 2	**Rev.** 1





IAC Irish Archaeological Consultancy	**Title**	Boharnamoe 1 plan of the site and section	**Scale** As Shown @A4	**Drawn by**	JR
	Project	N52 Ardee Bypass Scheme Phase II, Co. Louth	**Date** 23/04/2014	**Checked by**	FW
	Client	Louth County Council	**Job no.** J2787	**Fig.** 3	**Rev.** 1

Plate 1: Site, pre-excavation, facing NNW

Plate 2: Site, pre-excavation, facing north, showing Trough C3

Plate 3: Trough C3, half section (Section 1a–b), facing NNW

Plate 4: Trough C3, post-excavation, facing NNW

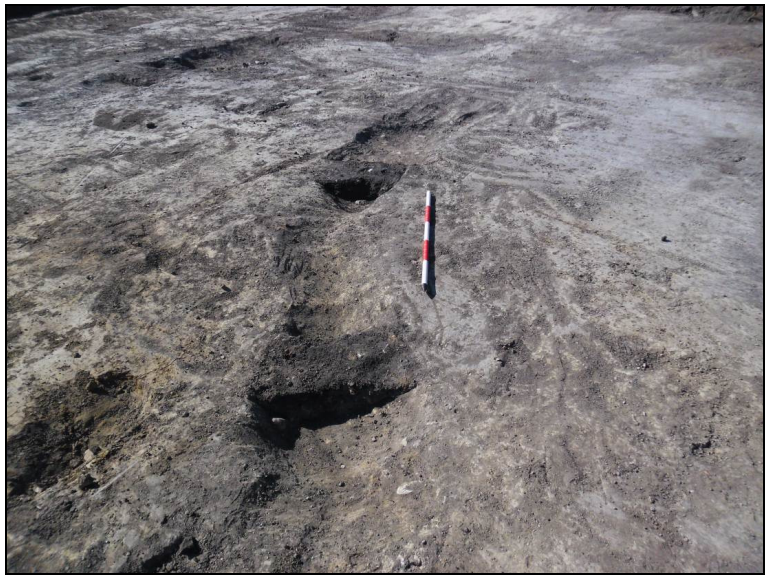


Plate 5: Curvilinear plough furrow, facing north-west

Plate 6:Linear plough furrow, facing NNW