

**N6 Galway to East Ballinasloe Road Scheme:
Archaeological Resolution
of Human Skeletal Remains
Ballygarraun West townland, Co.Galway**

**FINAL REPORT
E2534
Ministerial Directions A024**

Site Director: J.Lehane
Job No.: 1187-05-400
Client: Galway County Council
Date: February 2008

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1.0 Summary

This report describes the programme of archaeological excavation at Ballygarraun West (Ministerial Directions A024, Excavation No: E2534) as part of the proposed N6 Galway to East Ballinasloe scheme Contract 1 (Doughiska to Ballygarraun South) on behalf of Galway County Council.

Testing was initiated in Area 1.15 due to the discovery by geophysical survey of multiple pit features. The purpose of the testing was to ascertain the character, significance and extent of these features. Testing showed that the pits were of no archaeological significance; however, a single inhumation was uncovered during the course of testing. This was subsequently excavated and recorded by Dr. Patrick S. Randolph-Quinney of ODK Resources. The site consisted of a single and isolated inhumation. Human skeletal remains recovered were in poor condition and several pieces of red deer antler were found in association with the grave. The burial has been radiocarbon dated to between the late 6th and mid 7th centuries. The site was to be removed during the course of the construction of the proposed dual carriageway.

2.0 Acknowledgments

The project was funded by the Department of Transport under the National Development Plan 2000-2006. The total archaeological cost was supplied by the National Roads Authority through Galway County Council.

The archaeological testing was initiated by John Lehane and completed by Eoghan Moore for Valerie J. Keeley Ltd and the subsequent full excavation of the site was completed by Dr. Patrick S. Randolph-Quinney of ODK Resources.

Valerie J. Keeley Ltd would like to acknowledge the assistance of Project Archaeologist NRDO Jerry O'Sullivan and Martin Jones Assistant Project Archaeologist NRDO also Ross McLeod Project Archaeologist RPS/MCOS and Niall Healy Land Owner Liaison Officer RPS/MCOS.

Valerie J. Keeley Ltd would also like to acknowledge the assistance and co-operation of the land-owners and residents who facilitated access.

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4.0 Introduction

Archaeological testing with subsequent excavation of skeletal remains took place at Ballygarraun West, Co. Galway (Excavation No. E2534) as part of the proposed N6 Galway to East Ballinasloe scheme Contract 1 (Doughiska to Ballygarraun South) on behalf of Galway County Council. The purpose of this work was to preserve by record this archaeological site along the route of the proposed dual-carriageway. The area under investigation was identified in the Council's specification for the work as Area 1.15.

5.0 Project Background

The proposed archaeological testing was carried out in response to recommendations made by the Project Archaeologist following the EIS report for the N6 Galway to East Ballinasloe scheme and a geophysical survey (ArchaeoPhysica 2004).

6.0 Site Description

The site was in the townland of Ballygarraun West, Co. Galway (NGR 148207, 227273). It was located at Chainage 13725-13765. The site is located in a tillage field southwest of Athenry in east Co. Galway and is afforded fine views to the north and east but fairly limited views to the higher land to the west and south. A large number of trees are also present towards the northwest. The site was identified as the remains of multiple pits discovered by geophysical survey carried out during the scheme and EIS was conducted prior to the commencement of archaeological excavation work on the site (ArchaeoPhysica 2004).

7.0 Methodology

A total of 1600 square metres of test trenches were to be excavated on the site with tracking machine with a 2 m wide toothless bucket. This machine was used to strip the topsoil, under archaeological supervision. In total six trenches were excavated across the site. The isolated inhumation uncovered during testing was excavated by hand.

8.0 Results

8.1 Archaeological Results

An isolated inhumation was uncovered during excavation. It consisted of a well defined sub-rectangular grave cut (C5) that had been heavily disturbed by ploughing activity. The grave lay directly beneath the topsoil (C1). The grave pit was very shallow (0.15-0.2 m deep) and measured 1.5 m in length and 0.8 m wide (see Plates 1, 2). The grave fill (C4) consisted of a mid brown, moderately compact silty clay with some large stones. The stones measured c. 0.2 m x 0.3 m in plan. The grave contained the fragmentary remains of a single human skeleton (C6) (see Appendix 2; Plate 3). This was in a very poor condition and was orientated east-west. The inhumation was in a supine position with arms and legs extended and the head to the west. The skeletal remains were found to be lying on a shallow bed of charcoal-rich soil containing plant and cereal remains and a small amount of burnt bone inclusions (C7) (see Appendix 3; Plate 4). The grave also contained several fragments of red deer antler. One piece in particular had been placed upon the pelvic girdle of the individual. Several large stones (C8) were identified scattered above the grave fill and possibly represented a disturbed covering cairn. An area measuring 15 m x 10 m was opened up around the feature to establish if it was isolated. No further graves were found.

8.2 Non-Archaeological Results

A large circular feature previously identified by the geophysical survey carried out on the site was located immediately to the south of the grave. The feature measured approximately 5 m in diameter and was filled by homogenous, light brown silty clay with occasional stone inclusions (C3). This feature was the result of percolation tests that were carried out in advance of the construction of the road.

9.0 Discussion

Analysis of the skeletal remains show that the inhumed individual was a mature female adult aged 50 years plus at the time of death. Radiocarbon dating of a sample of the human bone along with two samples from the charcoal-rich layer beneath the skeletal remains (A024/1.15:7:2; A024/1.15:7:3) suggest a date between the late 6th to mid 7th centuries AD (AD 578 to 661). This isolated inhumation is also located within an environment of early medieval sites including ringforts and enclosures (e.g. RMP Nos GA084/017, GA084/018, GA084/015, GA084/016, GA084/09 to GA084/014). This places the burial within an early medieval context and roughly around the time of the rise of Christianity in Ireland. However, evidence of the scattering of cereal grains and charcoal below the skeletal remains, in conjunction with the deliberate placing of the worked red deer antler on the pelvic region of the individual, suggest pagan burial practices. It would appear then that this isolated inhumation represents

a pagan burial and may have occurred during the transition period between pagan and Christian beliefs in Ireland.

Summary of radiocarbon dates returned from Ballygarraun West

Lab code	Sample material	Yrs BP	$\delta^{13}C$	1 sigma	2 sigma
UBA-7683	Unidentified human long bone	1471 ± 67	- 20.1‰	AD 540-649	AD 432-661
UBA-7863	Charcoal of Hazel and Alder from the carbonised layer (C7) below inhumation	1530 ± 33	- 28.1‰	AD 440-485 532-580	AD 432-600
UBA-7862	Charcoal of Hazel and Alder from the carbonised layer (C7) below inhumation	1424 ± 30	- 36.2‰	AD 610-649	AD 578-659

10.0 References

ArchaeoPhysica Ltd. 2004. *N6 Galway to East Ballinasloe – Geophysical Report*

APPENDIX 1
RECORDS, FINDS AND SAMPLES REGISTERS

Trench Register

Field No.	Trench No.	Length	Width	Archaeological Features
178	1	20 m	2 m	No Archaeological Significance
178	2	65 m	2 m	No Archaeological Significance
178	3	100 m	2 m	No Archaeological Significance
178	4	120 m	2 m	No Archaeological Significance
178	5	15 m	10 m	Grave
178	6	120 m	2 m	No Archaeological Significance

Context register

Context No	Dimensions	Context Descriptions
1	Site	A mid brown silty clay topsoil with frequent inclusions of angular stones and patches of burnt clay.
2	Site	Natural, consisting of broken and shattered bedrock with pockets of gritty gravel throughout. Bands of silty clay on lower ground.
3	5 m in diameter	Fill of percolation pit – homogenous light brown silty clay with occasional stone inclusion.
4	1.5 m L. x 0.8 m max W. x 0.15 –0.2 m D.	Fill of grave – a mid brown, moderately compact silty clay with some large stones, c. 0.2 m x 0.3 m in plan.
5	1.5 m L. x 0.8 m max W. x 0.15 –0.2 m D	Cut of C4
6	1.5 m L. x 0.8 m max W.	Inhumation (fill =C4, cut =C5)
7	1.5 m L. x 0.8 m max W. x 0.15 –0.2 m D	Carbonised layer below inhumation. Charcoal - rich clay with burnt bone inclusions.
8	Circa 0.2 m x 0.3 m	Irregular deposit. Layer of large stones lying above fill of inhumation.

Drawing Register

Drawing No.	Scale	Drawing type	Date	Contexts	Description
1	1:10	Plan	3/10/05	4, 5, 6, 7, 8	Mid-excavation plan of inhumation

Artefact Register

Find No.	Context	Taken by	Date	Description
1	C4	PDQ	30/10/05	Red deer antler

Sample Register

Sample No.	Context No.	Volume/No. of bags	Taken By	Date	Description	Reason for Sampling
1	C4	25 litres/5 bags	PDQ	3/10/05	Mid brown silty clay fill of grave	Sieving for small bones and bone fragment recovery
2	C7	2.5 litres/half one bag	PDQ	3/10/05	Carbonised pale brown silty clay	Environmental analysis
3	C7	0.5 litres/one small bag	PDQ	3/10/05	Dark brown carbonised wood and soil	Environmental analysis

Photo Register

Photo No.	Context Numbers	Facing	Area	Film type	Date	Comments
1	C1, C4, C5, C8	West	1.15	Digital	3/10/05	Pre-excavation of grave
2	C4, C5, C6	West	1.15	Digital	3/10/05	Mid-excavation of grave
3	C4, C5, C6	West	1.15	Digital	3/10/05	Skeletal remains
4	C5, C7	West	1.15	Digital	3/10/05	Layer under inhumation with charcoal - rich clay.

APPENDIX 2
OSTEOLOGICAL REPORT



**Osteological Analysis of Human
Skeletal Remains from
Ballygarraun West
(AR024/E2534), N6 Galway to
East Ballinasloe Road Scheme**

Report prepared for Valerie J. Keeley Ltd

Dr. Patrick S. Randolph-Quinney

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1. Introduction

Human skeletal and associated faunal remains were recovered on 3rd October 2005 from Ballygarraun West (Licence No. AR024/E2534). This material was discovered during Phase 1 archaeological testing as part of the proposed N6 Galway to Ballinasloe scheme Contract 1 (Doughiska to Ballygarraun South) on behalf of Galway County Council.

The purpose of the testing in this location was to ascertain the preliminary nature, date, function and cultural associations of an archaeological site identified as a pit group. The site was to be completely removed during the course of the construction. The testing showed that the pit was of no archaeological significance. However, an isolated human grave was also found within the trench. This grave was excavated and recorded by the author during this phase of work.

Human skeletal material was recovered from a single well-defined burial context in Test Trench 17. The material from Trench 17 was uncovered in a disturbed but articulated state, and is considered to comprise a single inhumation. In general the skeletal material was recovered in very poor condition, highly friable, weathered and heavily eroded. Active processes of physical disturbance, mechanical weathering, sub-surface erosion, and fluctuations in soil water content were implicated in the preservational process. This osteological analysis aims to provide an inventory of the skeletal material, the condition of the bone present, relative completeness and to provide, where possible, the age, sex and stature of the individual recovered, as well as any pathological conditions he/she may have suffered from.

2. Burial Environment and Stratigraphy

The inhumation was contained within a well-defined grave cut (C5) measuring 1.50m in length by 0.60m maximum width (plates 1 and 2, and figure 1). The upper surface of the grave directly underlay sod and topsoil (C1), and was highly disturbed by ploughing activity. The surface of the grave fill displayed a series of medium to large sized stones some of which were irregularly arrayed around the circumference, with the remainder displaying evidence of disturbance and breakage upon the surface of

the grave, suggesting the former presence of a covering cairn (C8), now dispersed. Two animal teeth were recovered from the interface between the topsoil and grave fill (sample AR024/E2534:C4:F2). The surviving fill of the grave (C4) was relatively shallow (0.15 to 0.20 metres in depth) and comprised a mid-brown compact silty-clay, containing occasional small to medium-sized sub-angular to rounded clastic components

The grave was excavated by hand. The highly fragmented remains of a single inhumation were found within the grave fill. The inhumation was deposited in a supine position, oriented east-west, with the head to the west. The surviving articulated elements suggested the arms were arrayed in a flexed position, and the hands placed across the lap, and the feet extended and parallel to each other. A short portion of antler (find AR024/E2534:C4:F1) was found wedged within the pelvic girdle of the skeleton (plate 3). Other fragments of animal bone (sample AR024/E2534:C4:F3) were found around the head region of the burial. Upon lifting the inhumation, the lower limbs of the individual were found to have been lying on a shallow bed of charcoal-rich fill (C7) containing a small quantity of carbonised plant material and flecks of degraded bone (plate 4).

<i>Context</i>	<i>Dimensions</i>	<i>Description</i>
1	Site	A mid-brown silty-clay topsoil with frequent inclusions of angular stones and patches of burnt clay
2	Site	Natural, consisting of broken and shattered bedrock with pockets of gritty-gravel throughout.
4	1.5 m L. x 0.8 m max W. x 0.2 m D.	Fill of grave – a mid-brown, moderately compact silty-clay with occasional large stone clasts.
5	1.5 m L. x 0.6 m W. x 0.2 m max D.	Cut of C4
6		Inhumation
7	0.9 m L x 0.8 m max W.	Carbonised layer below inhumation. Charcoal rich clay with bone inclusions.
8	c. 0.2 m x 0.3 m	Irregular deposit. Layer of large stones lying above fill of inhumation



Plate 1: Pre-excavation view of grave.



Plate 2: Mid-excavation view of grave.



Plate 3: Mid-excavation view of exposed skeleton.



Plate 4: Mid-excavation view of charcoal-rich layer.

3. Materials and Process

The skeletal material was analysed in accordance with the standards recommended by the British Association for Biological Anthropology and Osteoarchaeology in conjunction with the Institute of Field Archaeologists (Brickley & McKinley, 2004), and the Institute of Archaeologists of Ireland (Buckley *et al.*, 2004).

Osteological recording was carried out using the reporting and coding procedures published by Buikstra & Ubelaker (1994), which has become the accepted standard for human osteological and forensic recording purposes. The material was analysed macroscopically and, where necessary, with the aid of reflective digital microscopy (x10 to x50) for identification purposes.

4. Reasons for Analysis and Scope of Reporting

Osteological analysis was carried out to ascertain:

- context and condition of the skeletal remains
- assessment of taphonomic or forensic traces and effects
- completeness of the bones
- inventory of the skeletal material
- age at death assessment
- sex determination
- assessment of adult stature
- skeletal pathology and anomalies
- assessment of intrusive non-human skeletal elements

5. Inventory of Skeletal Material

5.1 Introduction

An inventory of individuated skeletal material was recorded in tabular form and as a schematic (figure 2). The relative completeness of individual bones was assessed, with the overall percentage completeness of the individual skeleton recorded under the broad categories of 100% complete, >75%, 75-25%, and <25% of skeletal material remaining. The condition of the bone was recorded, providing an assessment of surface condition and overall skeletal quality.

5.2 Condition of Skeletal Material

A variety of perimortem events and postmortem processes can be inferred from the study of bone condition, surface modification, and shape, in particular qualitative assessment of bone condition is an aid in the identification of bio-stratinomic factors (e.g. weathering, trampling, abrasion, root etching, burning) that may affect the preservation and interpretation of a skeletal individual or assemblage. To this end the overall condition of the bone was assessed macroscopically and recorded according to the categories defined by McKinley (2004), which provides a seven-point grade system for recording the degree of surface modification of individual bones by erosional or weathering vectors, and Behrensmeyer (1978), which provides a six-point grading system for recording the degree of structural quality of the bone assemblage.

The condition of the burial was exceptionally poor. The bone was heavily mineralised and mottled on the surface, with the exosteal surfaces showing evidence of heavy abrasion with weathering scars. In the main these took the form of deep erosional pits and irregular scars, suggesting initial erosion by plant roots, later expanded upon by weathering agents; overall the skeleton was graded Stage 5+ (McKinley, 2004). The structural quality of the bone was exceptionally poor, being graded Stage 4/5 (Behrensmeyer, 1978.) with a fibrous and rough surface, and large open cracks present. The bone was falling apart *in situ* and was exceptionally fragile.

5.3 Completeness of Skeleton

This is a guide to the overall completeness of the individual's skeletal remains and is calculated according to the percentage of the bones present in relation to the total number of bones in a complete human skeleton. This comprises the cranial skeleton (skull and mandible) 20%, axial skeleton (torso) 40%, and appendicular skeleton (arms and legs) 40% (after Buikstra & Ubelaker, 1994). Assessment of completeness is based upon the percentage of skeletal elements that can be identified and attributed to individual element. Representative completeness is grouped into three categories >75%, 25 to 75%, and <25% of skeletal elements present.

The skeleton was incomplete and highly fragmented (see figure 2). The individual was estimated to consist of approximately 35% of its original skeletal content, being comprised of a small portion of occipital bone, much of the mandibular corpus and lower dentition, a small portion of the right maxilla, the left and right anterior iliac regions of the pelvis, a portion of both arms, and a relatively large proportion of both legs. Very little of the axial skeleton survived, with the exception of assorted vertebral and costal fragments. A small percentage of hand and foot bones were recovered. The individual falls into the 25% to 75% category.

6. Age Assessment

6.1 Introduction

Assessing the skeletal age at death (SAD) is an essential task in osteological analysis. SAD should not be viewed as equivalent to chronological age at death. During the developmental phase of growth (intra uterine to around 21 years old) SA determination is based upon: (1) well-understood and predictable rates for the formation and eruption of the dentition, and growth and ossification of the skeleton which are used to age infants (Scheuer & Black, 2000); (2) in juveniles and sub-adults the unification or fusion of the bones of the post-cranial skeleton provides a reliable marker within relatively tight statistical margins (*ibid.*). However, once adulthood is reached and growth has ended (c. 28 years), age determination becomes more difficult

as many of the criteria used are reflections of skeletal deterioration and ‘wear and tear’; as such they are highly variable in expression, and contextually mediated (Molleson and & Cox, 1993; İşcan & Loth, 1989). Ages derived from adult skeletons are quoted as young adult (roughly 20-35 years), middle adult (35-50 years), or mature adult (50+ years) based on the recommendations of Buikstra & Ubelaker (1994:9) and O’Connell (2004:18). Note that in certain circumstances it may be possible to confidently limit the SAD to either the upper or lower limits of the young and middle adult age brackets.

6.2 Observations

The skeleton was fully skeletally developed, with the epiphyses of the surviving proximal femora fused to the diaphyses with no evidence of fusion lines. These observations indicate that these remains were those of a skeletal adult. Both auricular surfaces survived (though somewhat eroded) enabling estimation of age at death; the surface was placed into Stage 7 of Lovejoy *et al.* (1985). The costal ribs and pubic symphyses did not survive intact, which may have provided evidence of more precise skeletal age.

The third permanent molars were not present, but appeared to have erupted and been evulsed antemortem on the basis of surviving right-side alveolar morphology. A small occlusal facet was noted on the distal margin of the right second mandibular molar indicating the third molar was in full occlusion at time of death. The surviving permanent dentition was heavily worn, in particular the occlusal enamel surface of surviving maxillary tooth row P³ to M¹, and mandibular M₁ and M₂ were completely worn away, almost to the cervix of the crown, with concomitant secondary dentine formation.

6.3 Results

Analysis of the skeleton indicated that the individual was skeletally adult. Though highly fragmented it was noted that the proximal femoral and epiphyses were fully fused to the shaft, with no indication of a fusion line, indicating that the individual was at least 16 to 19 years at death (Scheuer & Black, 2000). The surviving fragments of auricular surface suggested a skeletal age in excess of 50 years. This is

corroborated by assessment of dental attrition which indicates an age of >45 years (Brothwell, 1981). The lack of surviving pubic surfaces or costal rib ends meant that age at death could not be corroborated by further ageing techniques. On the basis of auricular morphology, dental eruption and attrition, and epiphyseal fusion this individual can be best categorised as mature adult (50+ years).

7. Sex Determination

7.1 Introduction

Humans display a discrete pattern of morphological differentiation between males and females, termed sexual dimorphism (SD). Some of these differences are associated with primary sexual characteristics of the reproductive system which includes pelvic morphology, while others present a host of inter-related morphological, physiological, and behavioural features that become manifest with the onset of the hormonal surge at puberty (Quinney & Collard, 1997). These are referred to as secondary sexual features. Sex determination from skeletal remains is relatively accurate, with some researchers reporting success rates of up to 97% in blind tests on known sex samples. Techniques generally used include morphological trait assessment (primarily cranial characters and differentiation in pelvic morphology), metric analysis and discriminant functions, depending on the completeness of the material (see St. Hoyme & İşcan, 1989; White & Folkens, 2000). These include:

- differentiation in cranial characters – the expression of the nuchal crest, mastoid process, supra-orbital margin and ridge, and mental trigone.
- differentiation in pelvic morphology – greater sciatic notch, ventral arch, sub-pubic concavity, pre-auricular sulcus, and sacro-iliac articulation.
- differentiation in overall size and robusticity including ratios of humeral/femoral head size, dental metrics, and joint surface area.

However, because sexually dimorphic features are primarily established at puberty sub-adults must be sexed with extreme caution and children and pre-adolescents cannot be readily or accurately sexed on morphological grounds alone (Holcomb &

Konigsberg, 1995; Hunt, 1990; Scheuer & Black, 2000) as primary and secondary sexual characters are not yet fully established.

7.2 Observations

The auricular fragments of the pelvic girdle recovered from the skeleton allowed sex determination of the individual to be made from qualitative assessment. Discrete morphology of the pelvic outlet was missing. Elements of the anterior portion of the ilium and the auricular surface were present enabling assessment of the form of the greater sciatic notch and the pre-auricular region. The form of the greater sciatic notch was wide and graded Stage 2 (after Buikstra & Ubelaker, 1994). A wide and shallow pre-auricular sulcus was present, graded Stage 2 (*ibid.*). The anterior mandible (chin region) was narrow and V-shaped in profile, with only moderate expression (Stage 3; *ibid.*) of a *trigonum mentale*; the *tuber symphyseos* (mental eminence) was moderately well developed, with only slight infero-lateral expression of bilateral *tuberculum mentale* (mental tubercles). The surviving cranial vault bones (occiput) were heavily eroded and did not allow for an informed estimation of sex to be made.

7.3 Results

The form of the greater sciatic notch, pre-auricular sulcus and anterior mandible suggests that the individual was female. This is supported by an overall low level of skeleton-muscular robusticity on the remaining portions of appendicular skeleton.

8. Stature Determination

8.1 Introduction

The reconstruction of adult stature and overall body size is routinely used to investigate secular change in archaeological populations through time. Calculation of adult height from skeletal remains is based on the fact that overall stature can be correlated with long bone length (assuming equality of body proportions). The bones

of the lower limb are generally more accurate in estimating stature than those of the upper limb.

8.2 Observations

Even though the skeleton was highly fragmented and fragile, an assessment of adult stature could be estimated on the basis of measurements of femoral length undertaken on *in situ* bone during excavation, supported by reconstruction of the surviving bone fragments. A right femoral length of 350 mm was estimated, which yielded an adult stature of $141.2 \text{ cm} \pm 3.72$ (137.5 to 145.0 cm) based on the regression of Jantz (1992). This size range is clearly accommodated within the confines of the grave cut (c. 150 cm) given the extended supine disposition of the body.

9. Pathology

9.1 Introduction

The study of palaeopathology investigates the evolution and expression of ancient disease processes through time and how human societies adapted to them. In studying diseases in archaeological populations we are primarily looking at those disease vectors that leave characteristic changes or lesions on the bony skeleton. Understanding the expression of such changes and the clinical impact that they had on the individual is important in understanding how past societies understood their environment, how they adapted to it biologically, or failed to, and how they tried to overcome the impact of disease and sickness through cultural intervention or palliative care. The range of diseases commonly encountered and investigated includes trauma, congenital abnormalities, circulatory disorders, joint diseases, infectious disease, diseases of the viscera, metabolic disease, endocrine disorders, haematological disorders, skeletal dysplasias, neoplastic disease, and various diseases and malformations of the dentition (Aufderheide & Rodríguez-Martin, 1998; Roberts & Manchester, 1996). Some, such as traumatic lesions, are due to the application of external forces on bone. Expression can range from the effects of crushes, trips or falls, to the impact of edged weapons and blunt force trauma. Others, such as the

metabolic disorders, arise through the deficiency of essential nutrients and vitamins or the surplus of toxins, and understanding their expression provides good evidence of dietary deficiency or environmental stress.

9.2 Observations and Results

Though the surviving skeletal tissue was highly fragmented and fragile in nature, ephemeral evidence remained of minor pathological ailments.

9.2.1. Osteoarthritis: The primary diagnostic features of joint disease include osteophyte formation, exosteal porosity, and eburnation. Osteophytes are bony formations which develop around the margin of a joint, with the term osteophytosis most frequently used in relation to the development of stabilizing lipping between adjacent vertebral centra. Porosity is defined by evidence of erosive pitting on the exosteal (outer) surface of a joint. Eburnation is the polishing of a joint surface, usually as a result of wearing away of joint cartilage, this trait being pathognomonic of osteoarthritis (OA). Evidence of all three criteria diagnostic of OA was recorded on the remaining fragments of lumbar vertebrae, with the surviving centra fragments exhibited moderate osteophytosis and porosity, moderate osteophytic lipping of both superior and inferior articular facets, and a single occurrence of eburnation facet (joint polish) on the joint surface of a superior articular process fragment.

The occurrence of OA tends to be age-related, and is suggested to occur in almost everyone over 40 in clinical experience (Ortner, 2003: 549). Changes visible on the skeleton are primarily the result of general wear-and-tear of joint structures, with accompanying degeneration of the cartilaginous support and/or bony hypertrophy as a means of mechanical stabilization; as such, the evidence for osteoarthritis is in keeping with the assessment of age at death.

9.2.2. Dental Disease: Pathological conditions were noted to affect the permanent dentition of the Ballygarraun individual as follows.

(1) A series of very slight linear hypoplastic grooves with slight pitting was noted on the labial (lip) crown surface of the surviving mandibular anterior tooth crowns (first incisor and canine). Hypoplastic defects occur as lines, grooves or pits on the enamel surface of a tooth. These are developmental defects in the form of enamel deposition which arise as the result of episodes of nutritional stress or pathological disturbance during crown formation. Crown formation of the permanent anterior dentition is completed by around 4.5 years (Scheuer & Black, 2000), so these defects can only provide an indication of systemic disturbance early childhoods. Their presence indicates a period of dietary or environmental stress during the first few years of life of this individual; this stress could be disease related (severe fever brought about by a non-specific disease vector), or due to dietary stress such as periods of greatly reduced calorific intake or calcium deficiency.

(2) Slight build-up of both supra and subgingival calculus was noted to affect the cervical margins of the surviving mandibular and maxillary posterior dentition (premolars and molar teeth); in all cases this calculus extends below the cervix. Calculus is a deposit made up of mineralized plaque, which commonly occurs in archaeological populations. In general, plaque is deposited strongly when sucrose is present in the diet. The form of these deposits can range from small flecks to substantial excrescences. Although the presence of calculus is generally painless for the affected individual, the presence of substantial deposits can contribute to the development of periodontal disease and infections.

(3) Peridontitis with concomitant alveolar resorption and remodelling was noted to affect the surviving *in situ* right-side maxillary and mandibular tooth rows. Periodontal disease (peridontitis) is characterised by inflammation of the tissues surrounding and anchoring the teeth. The early stage is characterized by gingivitis, which affects the cervical or gingival margins of the tooth crowns. If periodontal disease continues the underlying bone is affected and may be increasingly destroyed or resorbed, often leading to the evulsion of the tooth, and suppuration of the underlying tissues. Only the latter stages of peridontitis can be identified in archaeological bone as the aetiology results in visible resorption of the alveolar process. Plaque, calculus deposits, abscesses and metabolic diseases can all contribute

to the development of the condition, and the presence of the disease is generally seen as indicative of poor oral hygiene.

10. Associated Non-Human Remains

In addition to the human skeletal remains a number of non-human skeletal elements were recovered from the fill (C4) of the grave. Sample AR024/E2534:C4:F2 comprised two loose domestic cattle (*Bos taurus*) teeth, determined to be R. P₂ and R. P₄, which were recovered from the disturbed interface between topsoil and the surface fill of the grave. Sample AR024/E2534:C4:F3 was recovered from disturbed fill adjacent to the head region at the western end of the grave, and comprised two highly weathered fragments of ungulate mandibular corpus (deer or cattle) which cannot be unequivocally assigned to taxon.

Find AR024/E2534:C4:F1 was found lying within the pelvic girdle of the burial (see plate 3). This comprises a short length of weathered red deer (*Cervus elaphus*) antler. 150mm of tineless beam was present from the burr to just superior to the trez tine (plate 5). The antler was naturally shed, but displays clear evidence of secondary use. Though heavily weathered, the beam records six clusters of cuts and sharply-stepped chop marks around and at the base of the (former) trez tine, suggesting deliberate removal of this element (plate 6). No evidence of use was noted at the base of the brow tine or the burr.



Plate 5. Red deer antler AR024/E2534:C4:F1.

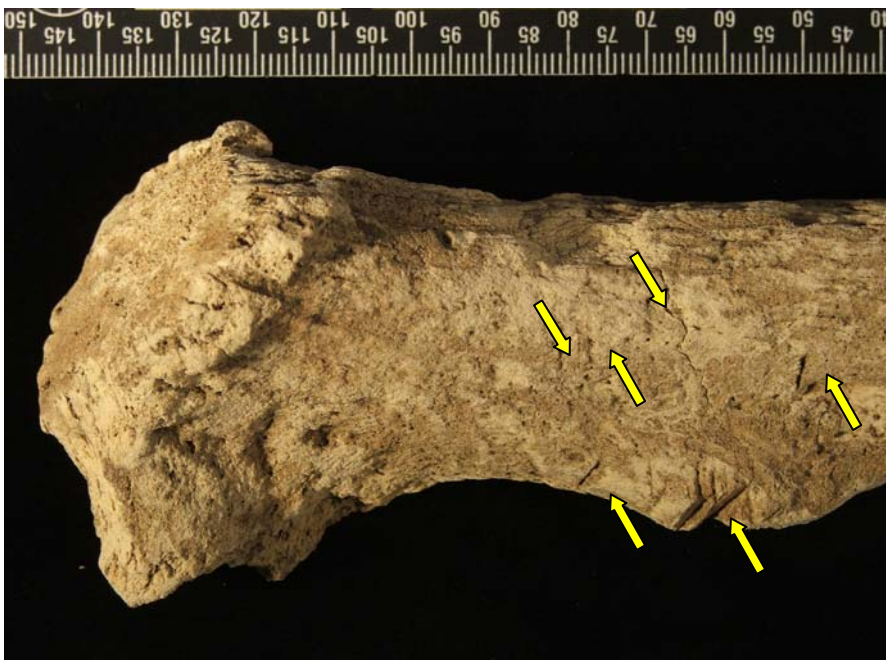


Plate 6. Cut and hack marks at base of trez tine and on body of beam (arrowed).

11. Summary

	<i>AR024/E2534</i>
Type of deposit	Inhumation Possibly cairn covered
Orientation	East-west (head to west)
Disposition	Extended supine Upper limbs flexed, hands arranged over pelvis, lower limbs extended with feet placed parallel
Burial capsule	None
Bones present	See figure 2
Percentage present	35%
MNI	1
Bone condition	Extremely poor (5+) Evidence of deep erosional pits and irregular scars, with extensive erosion by plant roots
Bone structure	Extremely poor (4/5) Bone displays fibrous rough surface, with large open cracks present. Bone falling apart <i>in situ</i> and exceptionally fragile
Taphonomic traces	Recent plough disturbance Plant root action Sub-surface weathering Ground water fluctuations?
Age at death	Mature Adult >50 years Based on auricular surface and dental wear
Sex	♀ Based on pelvic and mandibular morphology
Stature	141.2 cm ± 3.72 (137.5 to 145.0 cm)
Pathology	Spinal osteoarthritis Dental calculus Enamel hypoplasia Peridontitis
Associated finds	Naturally shed red deer antler with evidence of deliberate utilisation (cut and chop marks)

12. References

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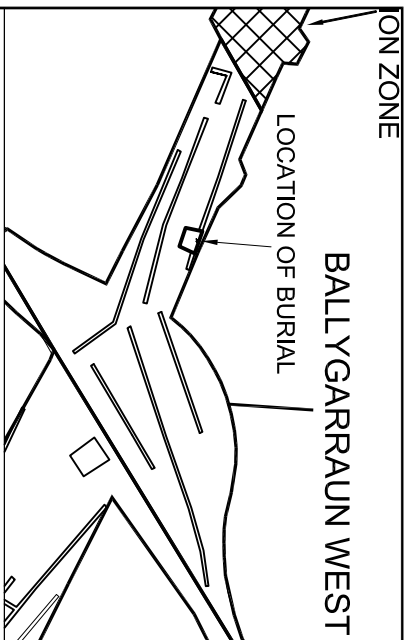
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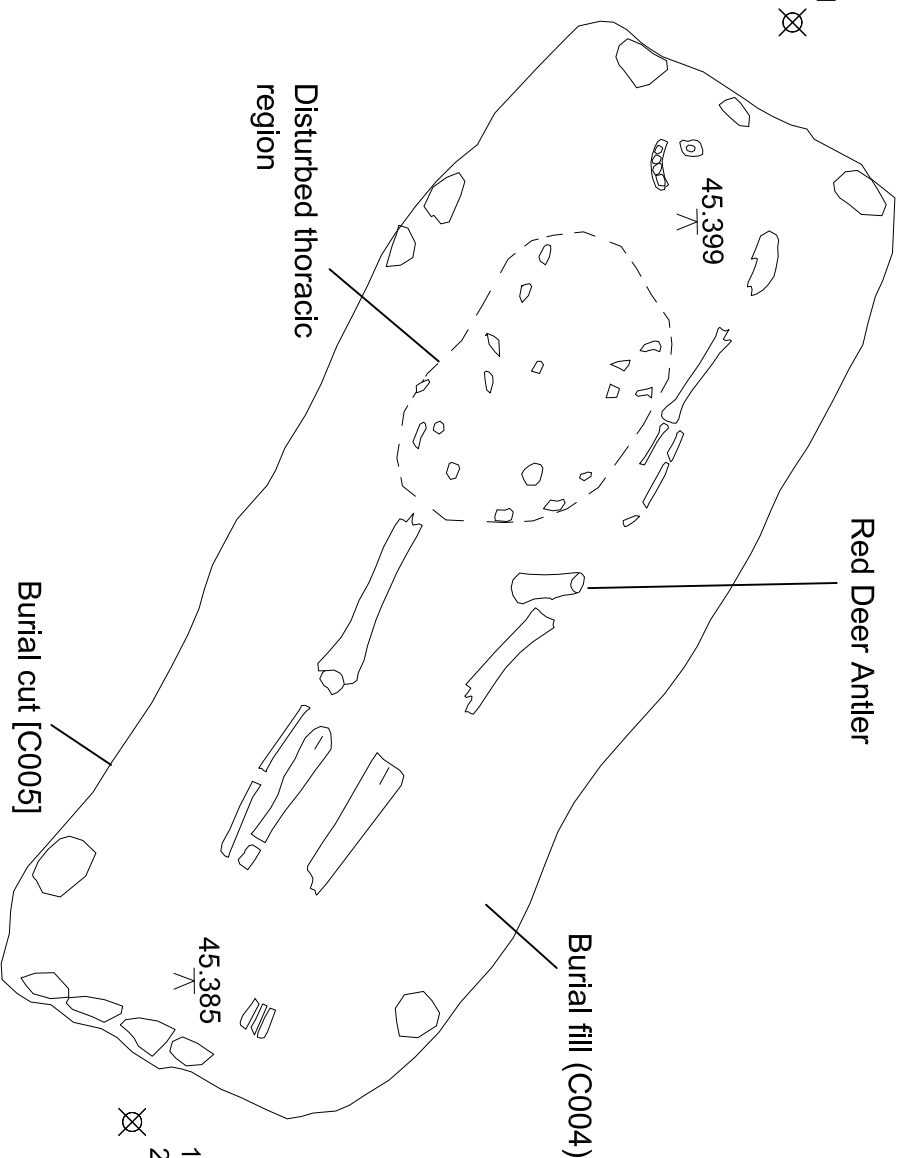
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148172.963E
227312.281N



0.5M

Burial cut [C005]

Burial fill (C004)

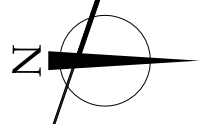
Red Deer Antler


Disturbed thoracic region

45.399

45.385

148174.417E
227311.408N



Title Fig. 5 Location and plan of burial in Area 1.15		Notes			
Job/Esc No. A024/1.15 E2534	Completed by O. Ryan	CAD reference 1187-05-400/TERA3	Client Galway County Council	 <p>Valerie J. Keely Ltd. Archaeological Consultancy</p> <p>Brehon House Castlescorner Co. Kilkenny.</p> <p>Tel: (+353) 056 4440236 Fax: (+353) 056 4440237 email: vk@vjk.ie</p>	
Date Feb 2006	Scale 1:10	Drawing No. Fig. 5	Project N6 Galway to Ballinasloe		

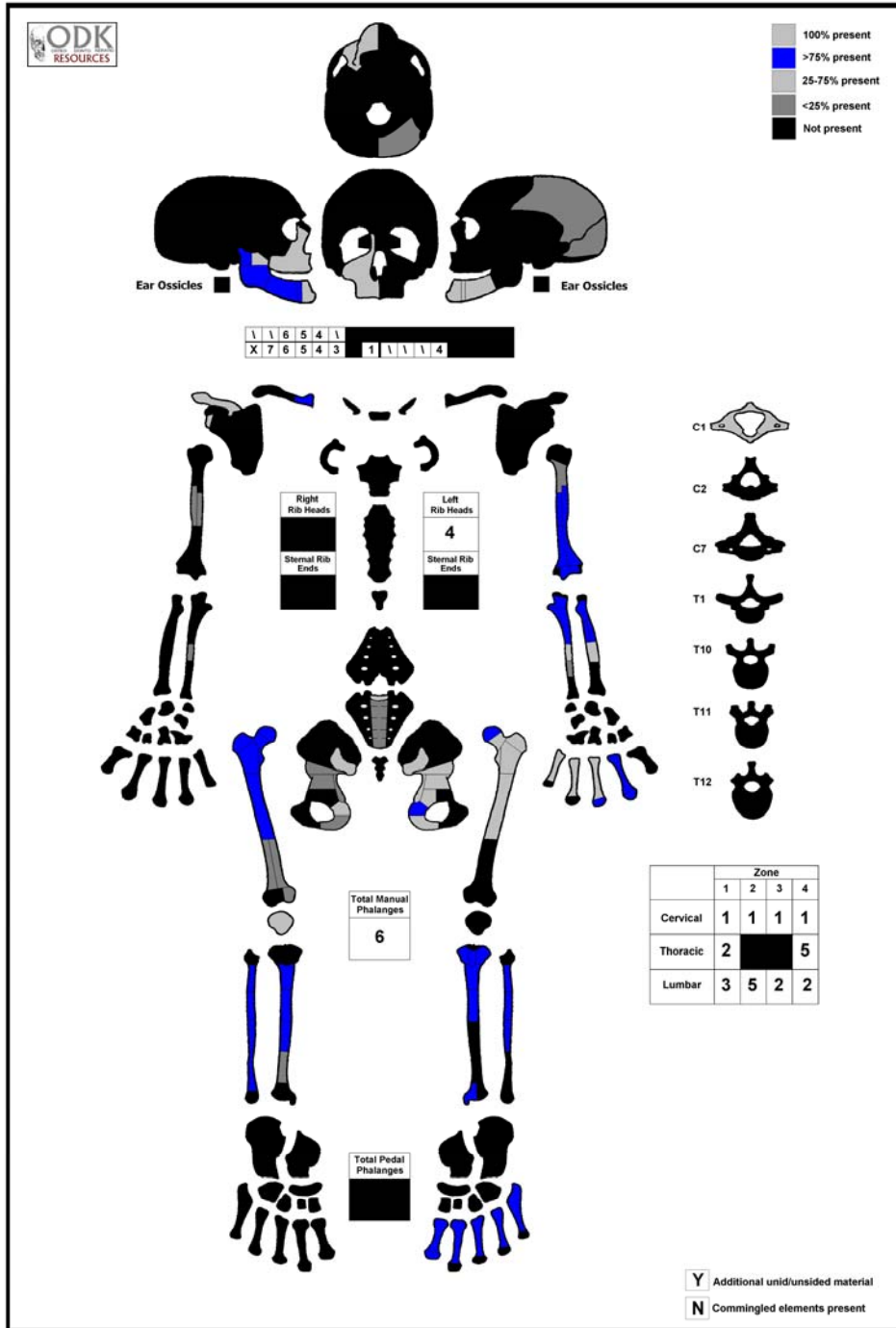


Figure 2: Schematic of human remains from Ballygarraun West A024/E2534

APPENDIX 3
PLANT REMAINS REPORT

Plant remains from Ballygarraun, Co Galway E2534

By Mary Dillon

Introduction

Two samples were submitted for plant remains analysis from the excavation of an inhumation burial at Ballygarraun, Co. Galway. The inhumation was lying on a shallow bed of carbonised clay containing a small amount of burnt bone inclusions. The burial was dated to between the 5th and 7th century AD.

Methodology

Bulk soil samples were collected on site and were processed post-excavation using a simple flotation method. Each sample was saturated in water to allow the carbonised plant material to float. This was then poured off into a series of sieves (1 mm and 250 µm), trapping the 'flot' (floating material) which was air-dried and stored in air-tight plastic bags. The flots were sorted and scanned for plant material and charcoal using a low-powered binocular microscope (magnification x 10 to x 40). Nomenclature and taxonomic orders follows Stace (1997).

Results

The two samples produced a small quantity of plant remains (Fig 1, Table 1). The most common seed type was barley cereal grain (17 grains).

Discussion

Barley is frequently found at sites from the early historic period and remains popular into the medieval period. Barley is often the most dominant cereal from early medieval sites. At several Munster sites it was the most frequent cereal along with oat (Monk et al. 1998). It became widespread and common in Ireland during the Bronze Age. It was likely an important food source as well as possible animal fodder (Tierney & Hannon 2003, 155). Although it can be difficult to distinguish between two-row and six-row barley, the latter variety appears to be more common from Irish early medieval sites (Monk 1986). No distinction could be made between two-row and six-row barley at Ballygarraun. One grain of wheat was identified. One seed of black bindweed (*Fallopia convolvulus*) was also present. This was probably growing in the fields and was processed with the cereal crop.

Why were there cereal grains deposited in the burial?

Charcoal burials are a remarkable phenomenon where a layer of charcoal is present in the grave fill either under or over the body, or in some cases completely encasing the remains. They are first documented in the 4th century in relation to St Martin of Tours and became common in the 9th to 12th centuries (Daniell 1997, 158). They seem to have been especially associated with high status burials in cathedrals or abbeys. It is unsure as to why charcoal was included. One idea is that the charcoal burials are reminiscent of pre-Christian cremations (ibid 183). Charcoal burials are also found in pagan Scandinavia, where the tradition continues to at least the 12th century. Chronological differences notwithstanding, it is interesting to consider the Ballygarraun burial against this background thus adding another dimension to the possible ritual and religious implications to this pit. It is possible that the plant

remains, mixed with charcoal, were deposited in a similar manner to the cases mentioned above.

Conclusion

Barley dominated the plant remains assemblage from the two small samples taken from the burial. Barley is frequently found at sites from the early historic period and remains popular into the medieval period.

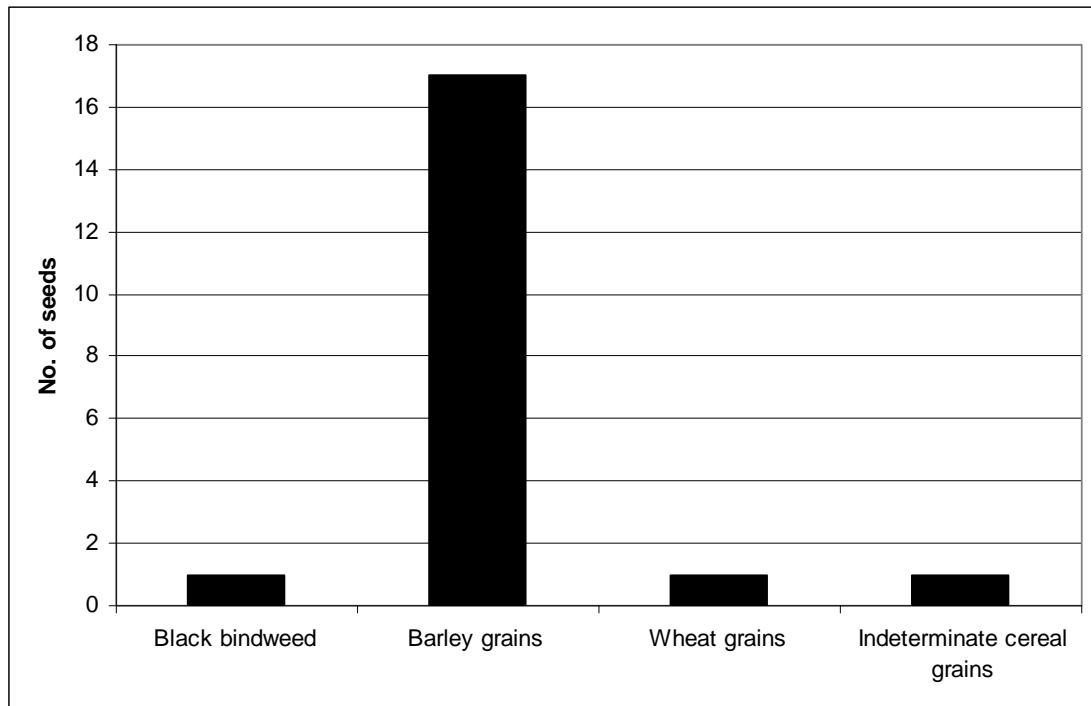


Fig 1. Bar chart showing frequency of plant remains from Ballygarraun

Table 1

Site	Ballygarraun	
Context	7 (charcoal-rich layer below inhumation)	7 (charcoal-rich layer below inhumation)
Sample	3	2
Black bindweed		1
Barley grains	1	16
Wheat grains		1
Indeterminate cereal grains	1	

References

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APPENDIX 4
CHARCOAL SPECIES IDENTIFICATION TABLE

**SPECIES IDENTIFICATION OF CHARCOAL SAMPLES
FROM E2534 BALLYGARRAUN WEST, CO. GALWAY**

By Ellen O'Carroll

Site no.	Townland	Context no.	Context type	Sample no.	Species	Weight (g)	No. of Fragments
E2534	Ballygarraun West	7	Carbonised layer below inhumation. Charcoal-rich clay with burnt bone inclusions	2	Hazel (<i>Corylus avellana</i>)	0.3	5
					Alder (<i>Alnus glutinosa</i>)	0.7	3
E2534	Ballygarraun West	7	Carbonised layer below inhumation. Charcoal-rich clay with burnt bone inclusions	3	Hazel (<i>Corylus avellana</i>)	1.5	16

APPENDIX 4
RADIOCARBON DATING

Radiocarbon Date Certificate

Queens University Belfast, 42 Fitzwilliam Street, Belfast BT9 6AX, Northern Ireland Laboratory

Laboratory Identification: UBA-7683

Date of Measurement: 2007-05-17

Site: Ballygarraun West E2534

Sample ID: Unidentified long bone

Material Dated: Human Bone

Pretreatment: Collagen

Submitted by: Valerie VJK Ltd

14C Date: 1471±67

13C: -20.1

RADIOCARBON CALIBRATION PROGRAM*

CALIB REV5.0.2

Copyright 1986-2005 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

Ballygarraun West UBA-7683 Radiocarbon Age BP 1471±67

Calibration data set: intcal04.14c	# Reimer et al. 2004	
% area enclosed	cal AD age ranges	relative area = under probability = distribution
68.3 (1 sigma)	cal AD 540- 649	1.000
95.4 (2 sigma)	cal AD 432- 661	1.000

References for calibration datasets:

PJ Reimer, MGL Baillie, E Bard, A Bayliss, JW Beck, C Bertrand, PG Blackwell.

CE Buck, G Burr, KB Cutler, PE Damon, RL Edwards, RG Fairbanks, M Friedrich.

TP Guilderson, KA Hughen, B Kromer, FG McCormac, S Manning, C Bronk Ramsey.

RW Reimer, S Remmele, JR Southon, M Stuiver, S Talamo, FW Taylor,

J van der Plicht, and CE Weyhenmeyer (2004), Radiocarbon = 46:1029-1058.

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)

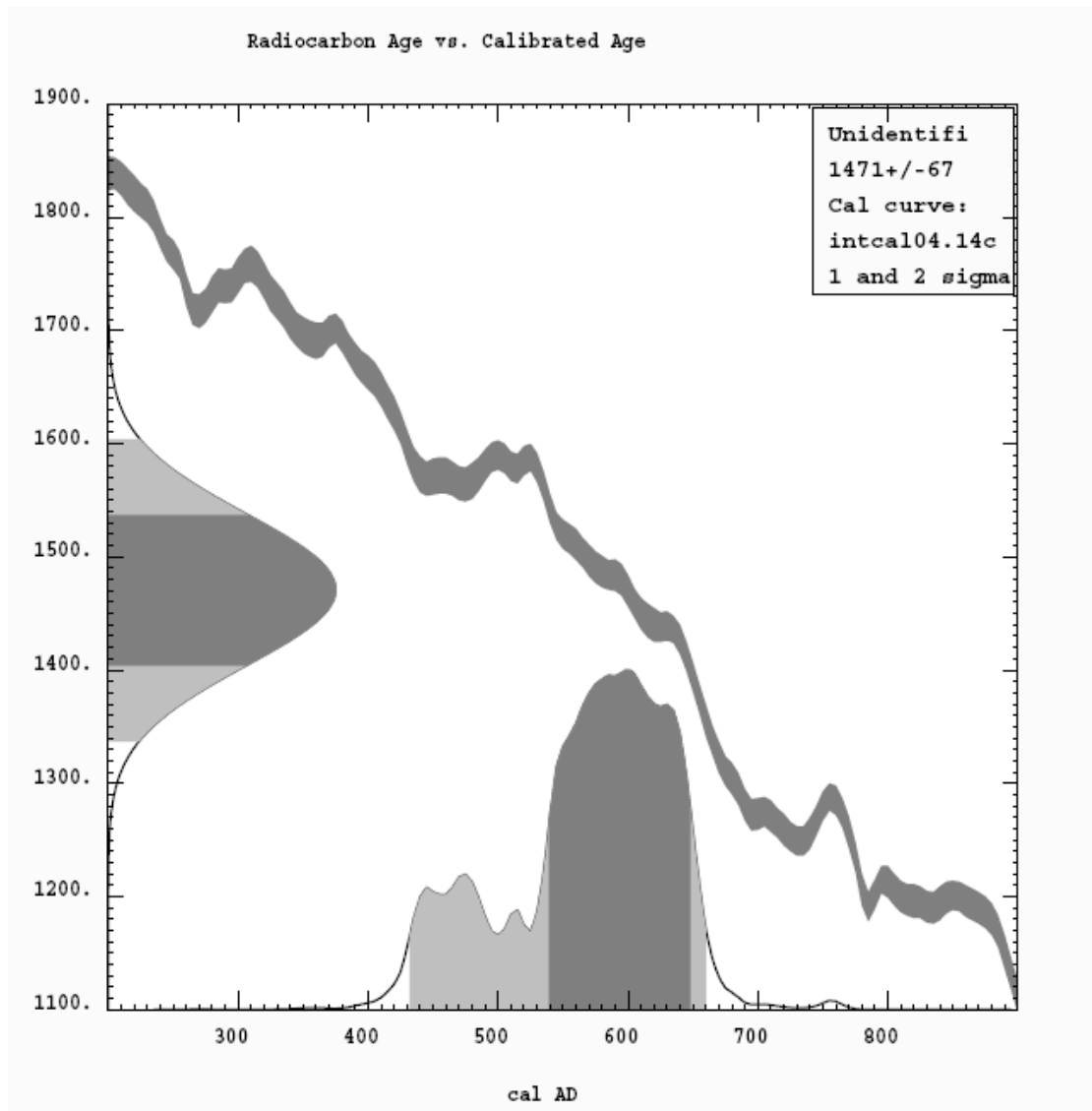
where ^2 = quantity squared.

[] = 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.



Radiocarbon Date Certificate

Queens University Belfast, 42 Fitzwilliam Street, Belfast BT9 6AX, Northern Ireland Laboratory
Laboratory Identification: UBA-7863
Date of Measurement: 2007-05-28
Site: Ballygarraun West A024/1.15
Sample:Context #: 2:7
Sample ID: Hazel and Alder
Material Dated: Charcoal
Pretreatment: AAA
Submitted by: Valerie VJK Ltd
14C Date: 1530±33
13C: -28.1

RADIOCARBON CALIBRATION PROGRAM*

CALIB REV5.0.2

Copyright 1986-2005 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

Ballygarraun West UBA-7863 Radiocarbon Age BP 1530±33

Calibration data set: intcal04.14c	# Reimer et al. 2004	
% area enclosed	cal AD age ranges	relative area = under probability = distribution
68.3 (1 sigma)	cal AD 440- 485	0.399
	532- 580	0.601
95.4 (2 sigma)	cal AD 432- 600	1.000

References for calibration datasets:

PJ Reimer, MGL Baillie, E Bard, A Bayliss, JW Beck, C Bertrand, PG Blackwell.

CE Buck, G Burr, KB Cutler, PE Damon, RL Edwards, RG Fairbanks, M Friedrich.

TP Guilderson, KA Hughen, B Kromer, FG McCormac, S Manning, C Bronk Ramsey.

RW Reimer, S Remmele, JR Southon, M Stuiver, S Talamo, FW Taylor,

J van der Plicht, and CE Weyhenmeyer (2004), Radiocarbon = 46:1029-1058.

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.

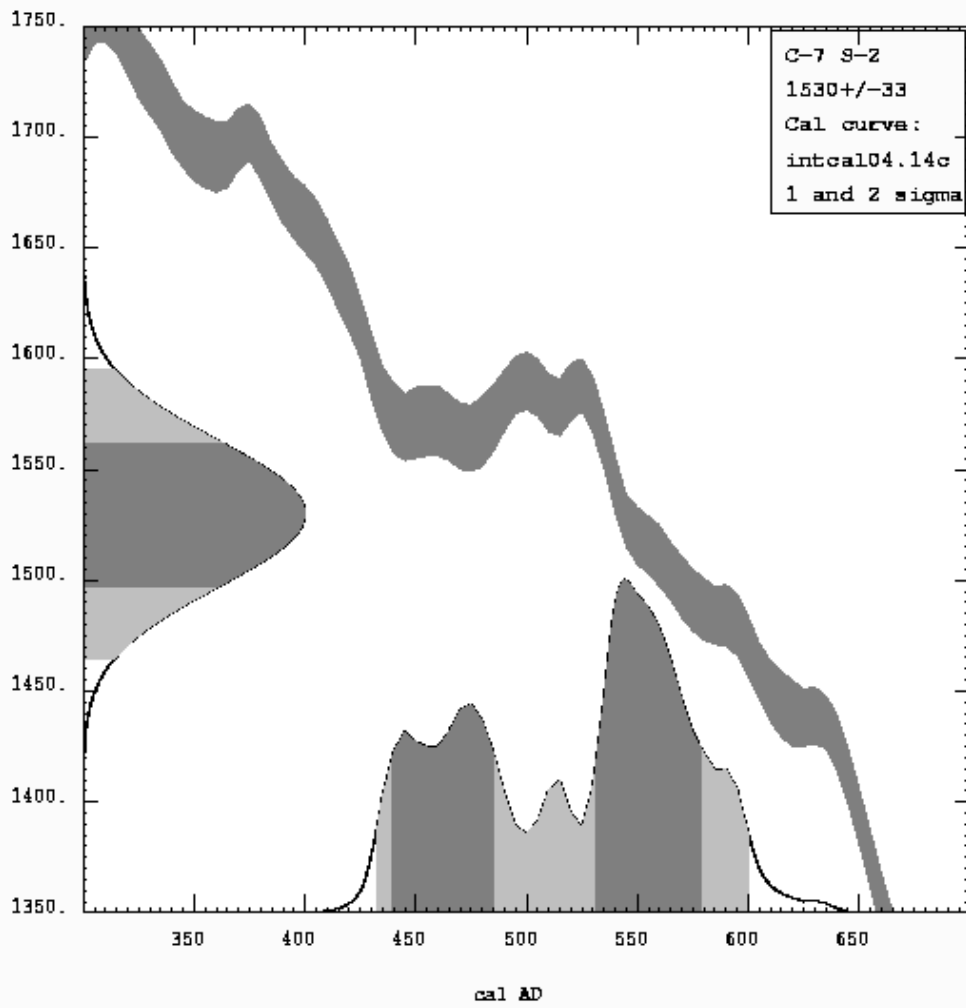
[] = calibrated range impinges on end of calibration data set

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.

Radiocarbon Age vs. Calibrated Age



Radiocarbon Date Certificate

Queens University Belfast, 42 Fitzwilliam Street, Belfast BT9 6AX, Northern Ireland Laboratory
Laboratory Identification: UBA-7862
Date of Measurement: 2007-05-28
Site: Ballygarraun West
Sample:Context #: 3:7
Sample ID: Hazel and Alder
Material Dated: Charcoal
Pretreatment: AAA
Submitted by: Valerie VJK Ltd
14C Date: 1424±30
13C: -36.2

RADIOCARBON CALIBRATION PROGRAM*

CALIB REV5.0.2

Copyright 1986-2005 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

Ballygarraun West UBA-7862 Radiocarbon Age BP 1424±30

Calibration data set: intcal04.14c	# Reimer et al. 2004	
% area enclosed	cal AD age ranges	relative area = under probability = distribution
68.3 (1 sigma)	cal AD 610- 649	1.000
95.4 (2 sigma)	cal AD 578- 659	1.000

References for calibration datasets:

PJ Reimer, MGL Baillie, E Bard, A Bayliss, JW Beck, C Bertrand, PG Blackwell.

CE Buck, G Burr, KB Cutler, PE Damon, RL Edwards, RG Fairbanks, M Friedrich.

TP Guilderson, KA Hughen, B Kromer, FG McCormac, S Manning, C Bronk Ramsey.

RW Reimer, S Remmele, JR Southon, M Stuiver, S Talamo, FW Taylor,

J van der Plicht, and CE Weyhenmeyer (2004), Radiocarbon = 46:1029-1058.

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)

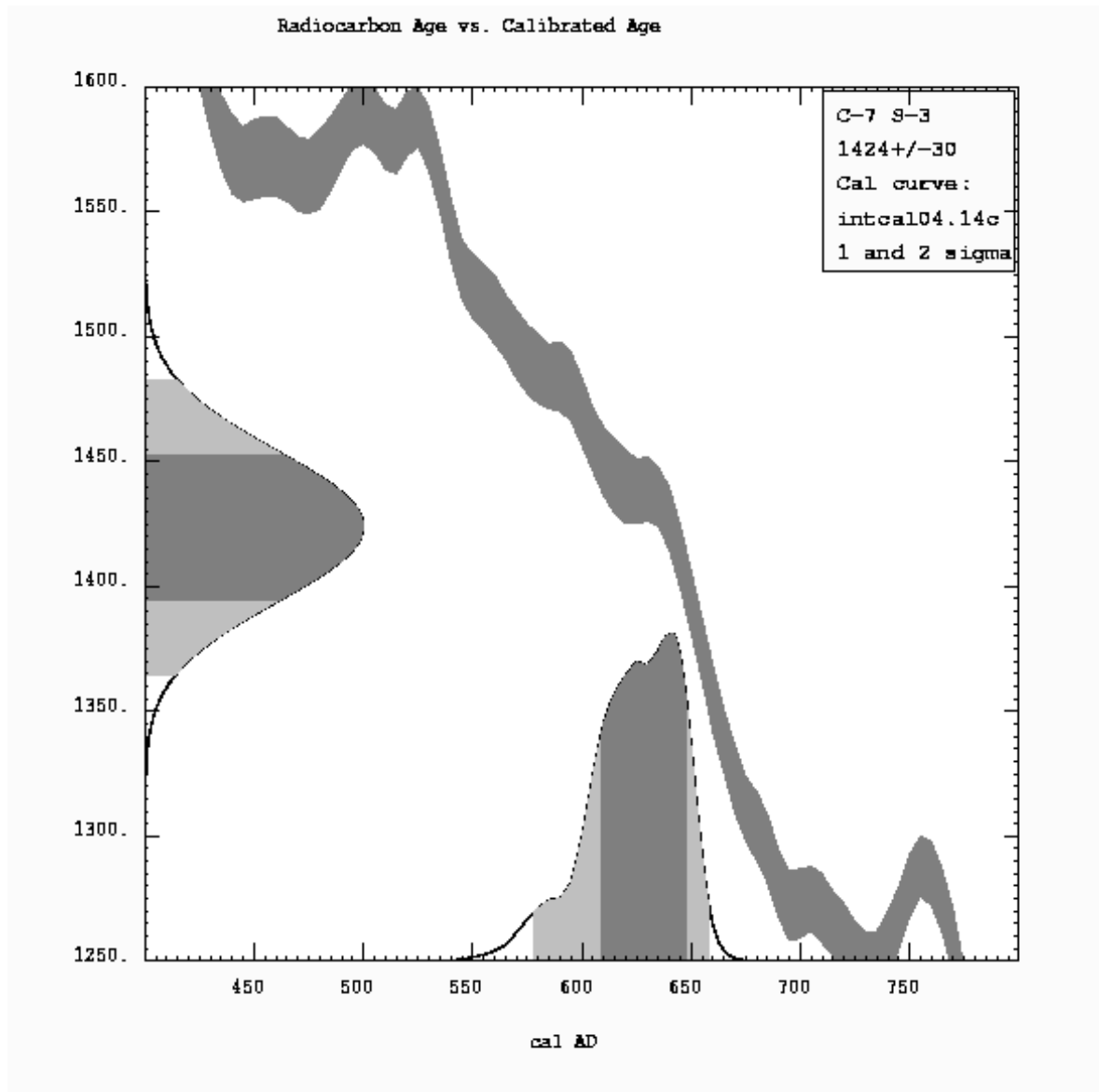
where ^2 = quantity squared.

[] = 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 5
PLATES AND FIGURES



Plate 1: Pre-excavation view of grave. Facing northwest.



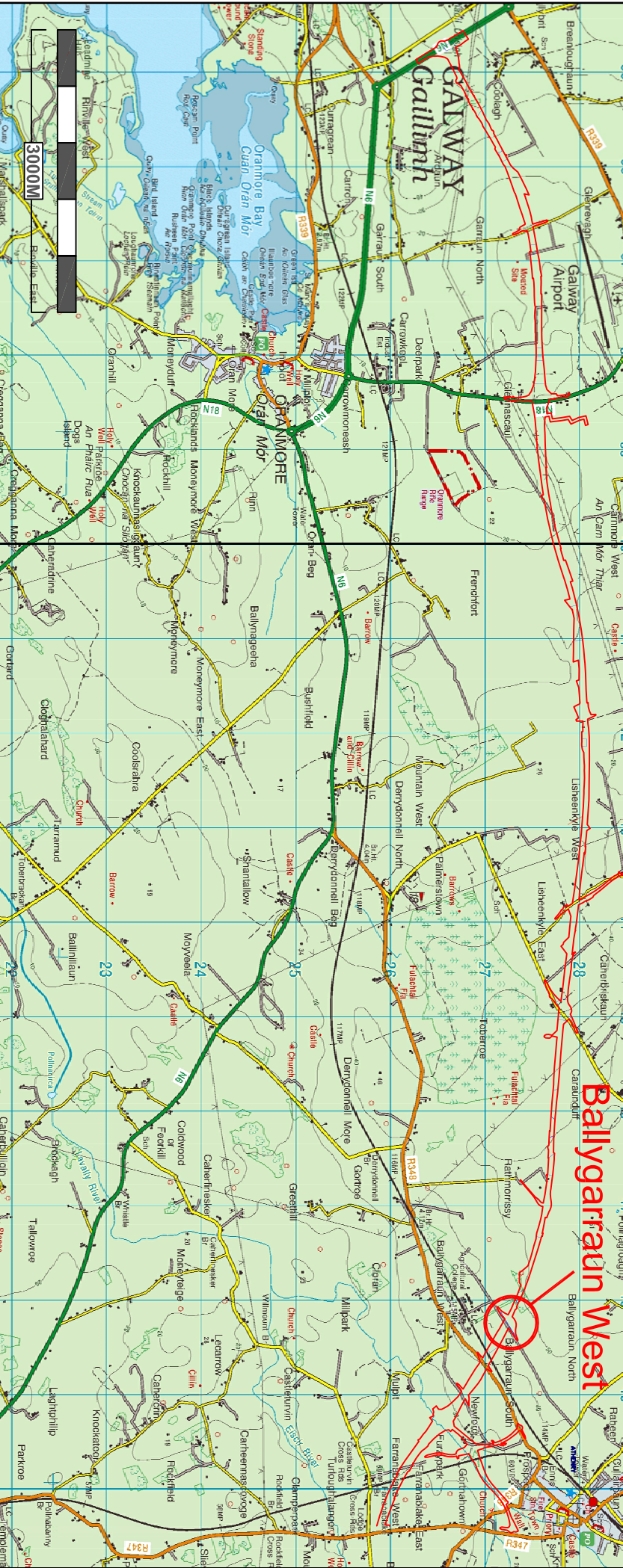
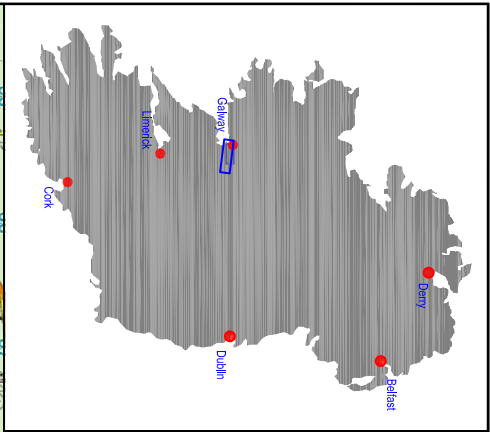
Plate 2: Mid-excavation view after removal of several large stones (C8) scattered above grave fill (C4). Facing northwest.



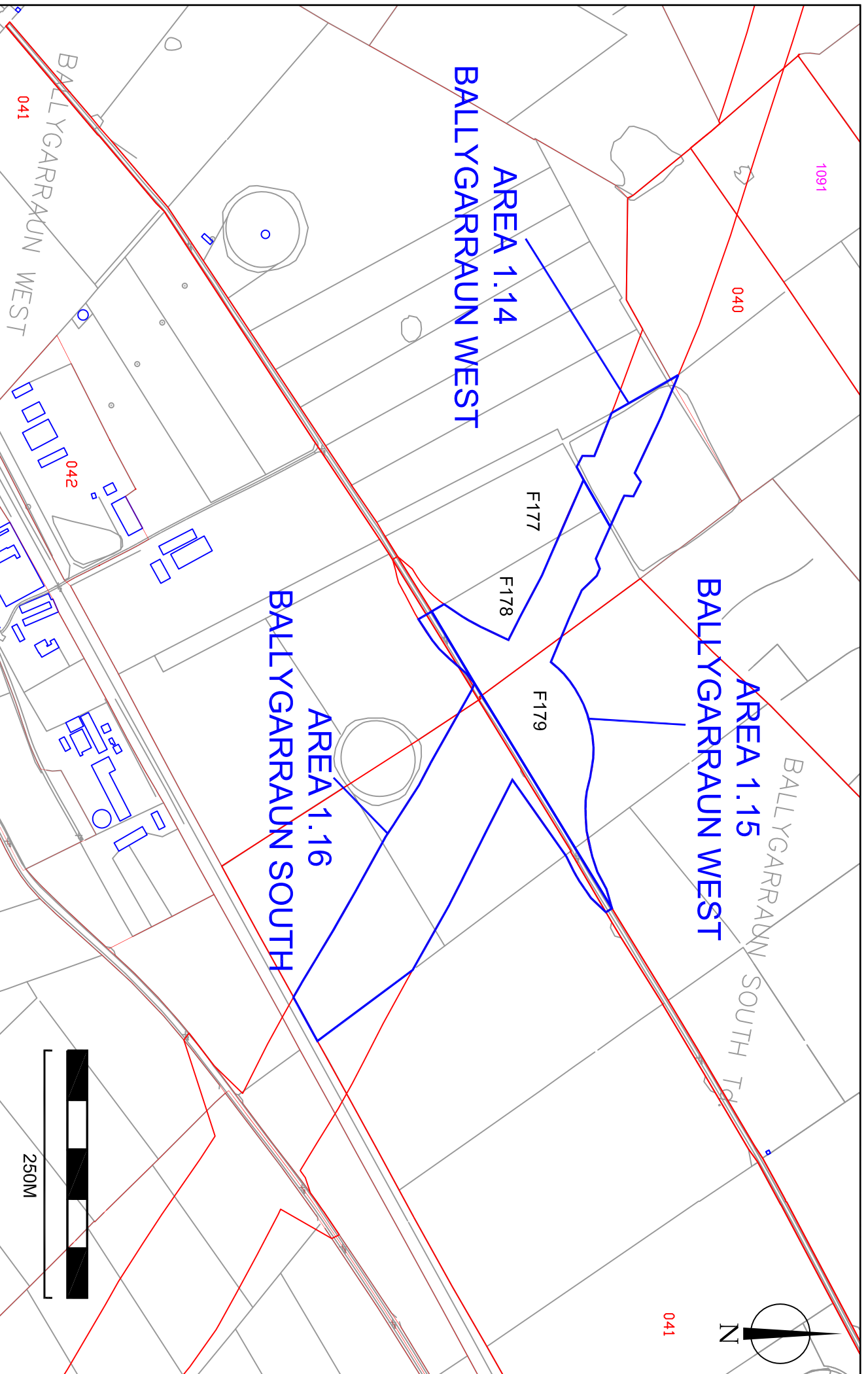
Plate 3: Mid-excavation view showing exposed skeletal remains (C6). Facing northwest



Plate 4: Mid-excavation view showing charcoal-rich layer (C7) after removal of human skeletal remains (C6). Facing northwest.




Title	Fig. 1 Location of site on Contract 1, N6 Galway to Ballinacorney			
	Notes			
Job/Exc. No.	A024/15		Completed by	O. Ryan
	E254			
Date	Nov 2005		Scale	1:50000
CAD reference	1187-05-400/TERA3		Drawing No.	Fig. 1
Client	Galway County Council			
Project	N6 Galway to Ballinacorney			
Valerie J. Regeley Ltd. Archaeological Consultancy				
Breton House Castlecorner Co. Kildenny.				
Tel: (+353) 056 4440236 Fax: (+353) 056 4440237 email: vk@vjr.ie				



Title
Fig. 2 Location of Area 1.15.

Notes

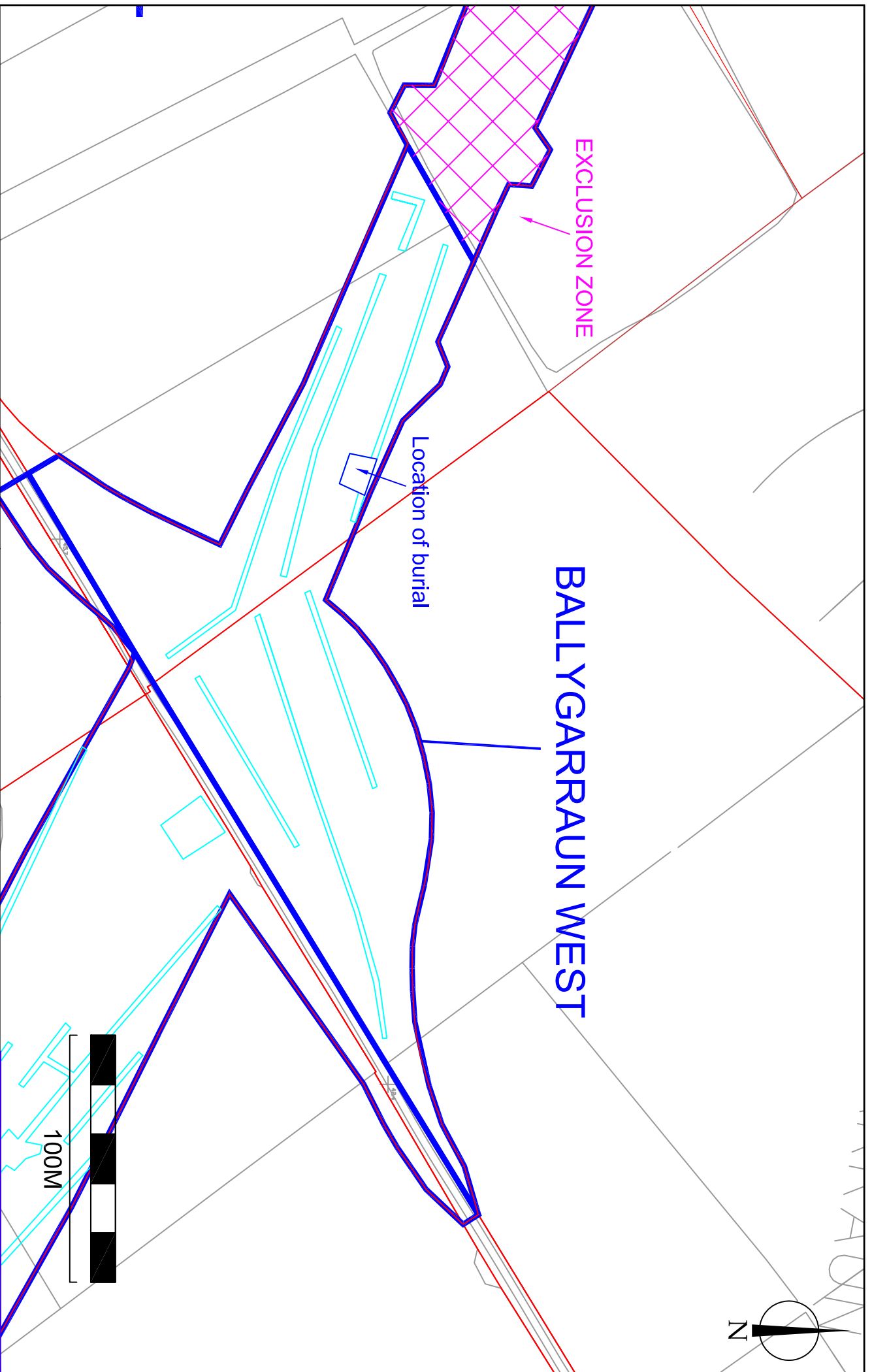
Job/Exc No. A02041.15 E2534	Compiled by O. Ryan	CAD reference 1187-05-400/TERA3	Client Galway County Council
Date Nov 2005	Scale 1:5000	Drawing No. Fig. 2	Project N6 Galway to Ballinasloe



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Fax: (+353) 056 4440237
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Title
Fig. 3 Trench Locations

Notes

- CPO
- Trenches
- Site Specific

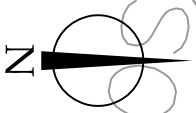
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Date Nov 2005	Scale 1:2000	Drawing No. Fig. 3	Project N6 Galway to Ballhasloe



Valerie J. Keely Ltd.
Archaeological Consultancy

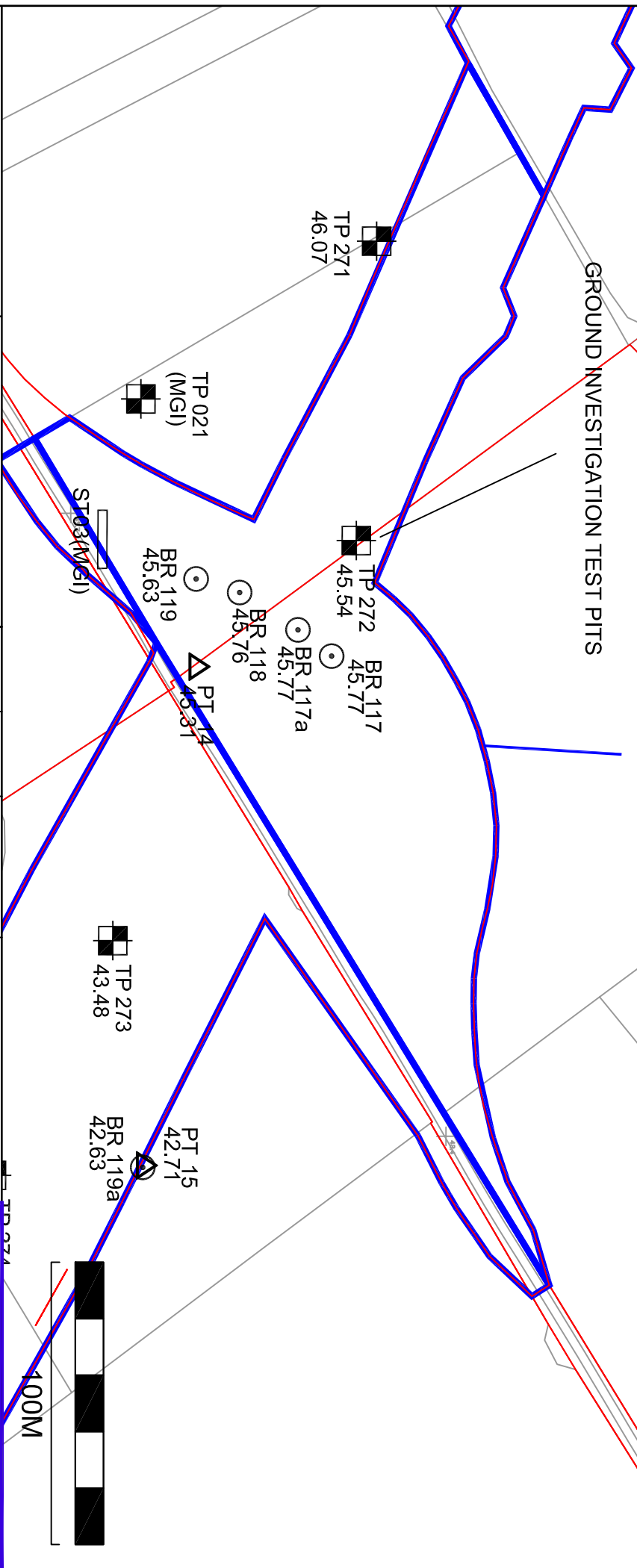
Breilton House
Castlescorner
Co. Kilkenny.

Tel: (+353) 056 4440236
Fax: (+353) 056 4440237
email: vk@vjk.ie



BALLYGARRAUN WEST

GROUND INVESTIGATION TEST PITS



TP 271
46.07

TP 021
(MGI)

ST03(MGI)

BR 119
45.63

BR 118
45.76

PT 14
45.31

BR 117a
45.77

BR 117
45.77

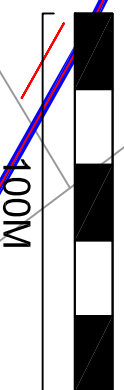
TP 272
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TP 273
43.48

BR 119a
42.63

PT 15
42.71

R124



Title
Fig. 4 Plan of Engineer's Test Pits

Notes
CPO
Test pits
Site Specific

Job/Esc No.
A024/L15
E534

Compiled by
O. Ryan

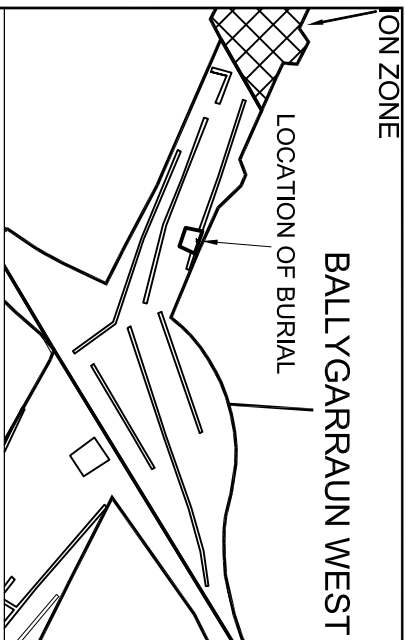
CAD reference
1187-05-400/TERA3

Client
Galway County Council

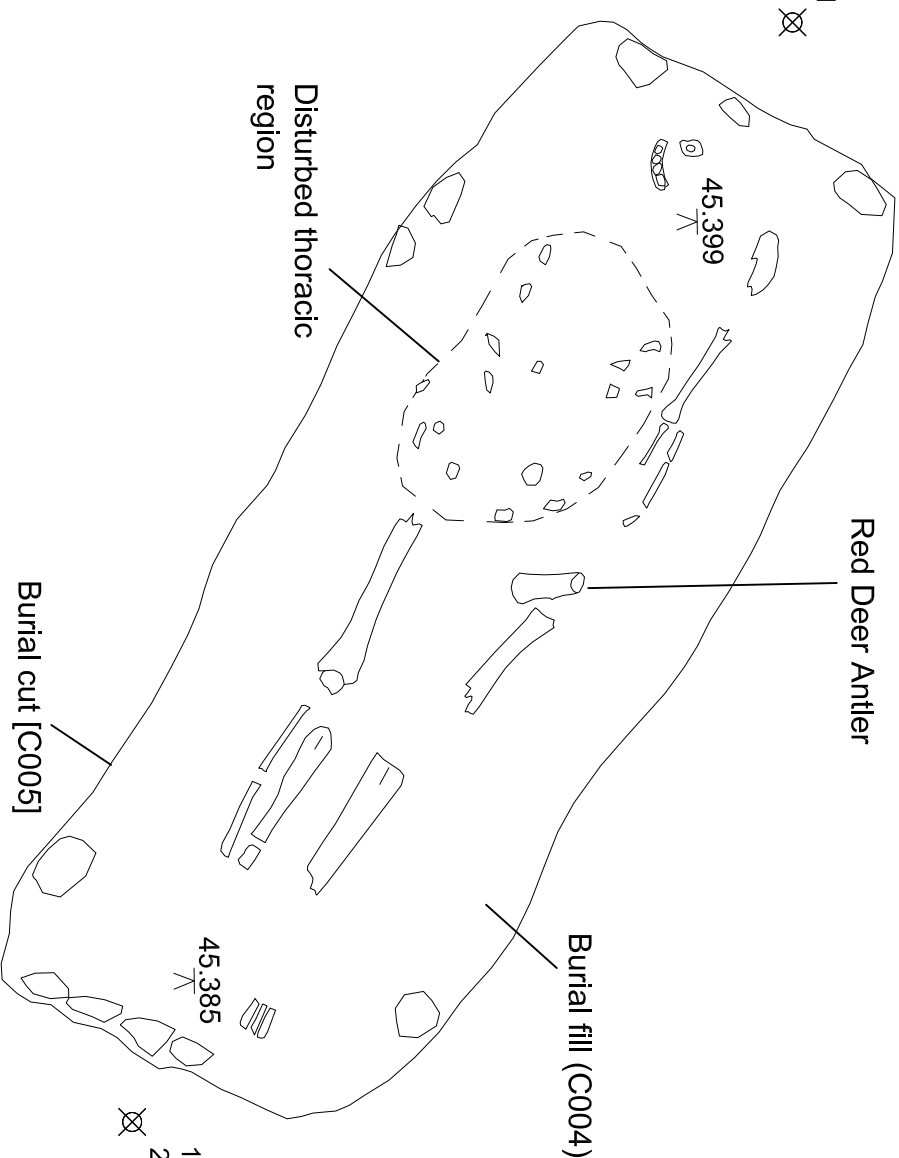
Project
N6 Galway to Ballinasloe



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148172.963E
227312.281N



0.5M

Burial cut [C005]

Burial fill (C004)

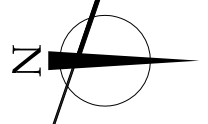
Red Deer Antler

Disturbed thoracic region

45.399

45.385

148174.417E
227311.408N



Title Fig. 5 Location and plan of burial in Area 1.15		Notes			
Job/Esc No. A024/1.15 E2534	Completed by O. Ryan	CAD reference 1187-05-400/TERA3	Client Galway County Council		
Date Feb 2006	Scale 1:10	Drawing No. Fig. 5	Project N6 Galway to Ballinasloe		
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