N9/N10 KILCULLEN TO WATERFORD SCHEME, PHASE 4 – KNOCKTOPHER TO POWERSTOWN

Ministerial Direction Scheme Reference No.	A032
Registration No.	E3731
Site Name	AR143, Cranavonane 3
Townland	Cranavonane
County	Carlow
Excavation Director	Ellen O' Carroll
NGR	269123 168362
Chainage	74640

FINAL REPORT

ON BEHALF OF KILKENNY COUNTY COUNCIL

JANUARY 2012

IAC Irish Archaeological Consultancy

PROJECT DETAILS

Project	N9/N10 Kilcullen to Waterford Scheme, Phase 4 – Knocktopher to Powerstown
Ministerial Direction Reference No.	A032
Excavation Registration Number	E3731
Excavation Director	Ellen O'Carroll
Senior Archaeologist	Tim Coughlan
Consultant	Irish Archaeological Consultancy Ltd, 120b Greenpark Road, Bray, Co. Wicklow
Client	Kilkenny County Council
Site Name	AR143, Cranavonane 3
Site Type	Kiln and pit
Townland(s)	Cranavonane 3
Parish	Tullowcreen
County	Carlow
NGR (easting)	269123
NGR (northing)	168362
Chainage	74640
Height OD (m)	53.542
RMP No.	N/A
Excavation Dates	2–5 October 2007
Project Duration	20 March 2007–18 April 2008
Report Type	Final
Report Date	January 2012
Report By	Ellen O'Carroll and Tim Coughlan
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ACKNOWLEDGEMENTS

This final report has been prepared by Irish Archaeological Consultancy Ltd in compliance with the directions issued to Kilkenny County Council by the Minister for Environment, Heritage and Local Government under Section 14A (2) of the National Monuments Acts 1930–2004 and the terms of the Contract between Kilkenny County Council and Irish Archaeological Consultancy Ltd.

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ABSTRACT

Irish Archaeological Consultancy Ltd (IAC), funded by the National Roads Authority (NRA) through Kilkenny County Council, undertook an excavation at the site of AR143, Cranavonane 3 along the proposed N9/N10 Kilcullen to Waterford Scheme, Phase 4 – Knocktopher to Powerstown (Figure 1). The following report describes the results of archaeological excavation at that site. The area was fully excavated by Ellen O' Carroll under Ministerial Direction A032 and Excavation Registration Number E3731 issued by the DOEHLG in consultation with the National Museum of Ireland for IAC. The fieldwork took place between the 2 and 5 October 2007.

The excavation identified a small oval cereal drying kiln and a pit. It is not clear if the two features are directly related although their relative proximity to each other and the lack of any other features on the site suggests they are most likely associated.

A sample of hazel charcoal from kiln fills C6, C7, C8 and C9 returned a 2 sigma calibrated date of 104BC–AD50 (UBA 12251). A sample of ash charcoal from pit fill C10 returned a 2 sigma calibrated date of 341–54BC (UBA 12252).

The excavation at Cranavonane 3 has produced evidence of an Iron Age cereal drying kiln and associated pit. The site is important locally as there is little evidence of prehistoric activity in the immediate area and no firm evidence dating to the Iron Age. It is also of interest in the wider analysis of the distribution and function of Iron Age sites in the area, for which there previously was little or no evidence. The site also provides evidence of middle Iron Age kiln technology.

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1 INTRODUCTION

1.1 General

This report presents the results of the archaeological excavation of Cranavonane 3, AR143 (Figure 1), in the townland of Cranavonane undertaken by Ellen O' Carroll of IAC, on behalf of Kilkenny County Council and the NRA, in accordance with the Code of Practice between the NRA and the Minister for Arts, Heritage, Gaeltacht and the Islands. It was carried out as part of the archaeological mitigation programme of the N9/N10 Kilcullen to Waterford Road Scheme, Phase 4, which extends between Knocktopher in Co. Kilkenny to Powerstown in Co. Carlow. The excavation was undertaken to offset the adverse impact of road construction on known and potential subsoil archaeological remains in order to preserve the site by record.

The site measured 340m^2 and was first identified during testing carried out between 27 March and 6 April 2007 by James Kyle (E3366) for IAC Ltd. on behalf of the National Roads Authority. Cranavonane 3 was excavated between the 2 and 5 October 2007 with a team of one director and three assistant archaeologists.

1.2 The Development

For the purposes of construction, the N9/N10 Kilcullen to Waterford Road Scheme has been divided into separate sections, known as Phases 1-4. Phase 2 of the scheme extends from the tie-in to the Waterford City Bypass at Dunkitt, to Knocktopher in Co. Kilkenny (Ch. 2+000–Ch. 25+400). Phase 4 continues from Knocktopher to Powerstown in Co. Carlow (Ch. 25+400–Ch. 76+000) and includes the Kilkenny Link Road.

The roadway of the entire scheme includes approximately 64km of mainline high quality dual carriageway and 6.2km of the Kilkenny Link Road, which will connect the road development to the Kilkenny Ring Road Extension. The road development requires the realignment and modification of existing national, regional and local roads where the mainline intersects them. It requires the acquisition of 305 hectares of land for its construction. A further link road will connect the scheme to Paulstown in County Kilkenny, while six new grade separated junctions and three roundabouts are part of the road development.

1.3 Archaeological Requirements

The archaeological requirements for the N9/N10 Kilcullen to Waterford Road Scheme, Phase 4: Knocktopher to Powerstown, are outlined in the Archaeological Directions issued to Kilkenny County Council by the Minister for Environment, Heritage and Local Government under Section 14A (2) of the National Monuments Acts 1930–2004 and in the terms of the contract between Kilkenny County Council and Irish Archaeological Consultancy Ltd. These instructions form the basis of all archaeological works undertaken for this development. The archaeological excavation works under this contract are located between the townlands of Knocktopher, Co. Kilkenny, and Powerstown, Co. Carlow.

The proposed N9/N10 was subjected to an Environmental Impact Assessment, the archaeology and cultural history section of which was carried out by Valerie J. Keeley Ltd and published in February 2005. The Record of Monuments and Places, the Site Monument Record, Topographical files, aerial photography, the Kilkenny and Carlow County Archaeological Urban Survey, and literary sources were all consulted. Two phases of geophysical survey were also conducted by Target (post-EIS geophysics carried out by ArchaeoPhysica) and an aerial survey was carried out by Margaret Gowen & Co. Ltd. As a result of the paper survey, field inspections and geophysical

survey, 35 sites were recorded in proximity to this section of the overall route alignment.

A previous archaeological assessment of Phase 2 of the scheme (test trenching conducted by Margaret Gowen & Co. Ltd. in 2006) extended into the lands acquired for Phase 4 to a point at Ch. 37+100 in the townland of Rathclogh, Co. Kilkenny. Thirty-four archaeological sites were identified within this area between Knocktopher and Rathclogh and subsequently excavated by Irish Archaeological Consultancy Ltd. as part of this archaeological contract.

Advance archaeological testing of the area between Rathclogh (Ch. 37+100) and Powerstown (Ch. 76+000) was completed by IAC during March–May 2007 and excavation of the sites identified during this process was also conducted by IAC between August 2007 and April 2008.

1.4 Methodology

The methodology adopted was in accordance with the approved Method Statement. The topsoil was removed to the interface between natural and topsoil using a 20 tonne mechanical excavator equipped with a flat toothless bucket under strict archaeological supervision. The remaining topsoil was removed by the archaeological team with the use of shovels, hoes and trowels in order to expose and identify the archaeological remains. A site grid was set up at 10m intervals and was subsequently calibrated to the national grid using GPS survey equipment.

All archaeological features were fully excavated by hand and recorded on *pro forma* record sheets using a single context recording system best suited to rural environment, with multi context plans and sections being recorded at a scale of 1:50, 1:20 or 1:10 as appropriate.

A complete photographic record was maintained throughout the excavation. Digital photographs were taken of all features and of work in progress.

An environmental strategy was devised at the beginning of the excavation based on IAC in-house post-excavation and site methodologies and guidelines. Features exhibiting large amounts of carbonised material were the primary targets.

No artefacts were uncovered on site. All archive is currently stored in IAC's facility in Lismore, Co Waterford and will ultimately be deposited with the National Museum of Ireland.

All dating of samples from the site was carried out by means of AMS (Accelerator Mass Spectrometry) Radiocarbon Dating of identified and recommended wood charcoal samples. All calibrated radiocarbon dates in this report are quoted to two Sigma.

All excavation and 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 DoEHLG and the National Museum of Ireland. Where necessary licences to alter and export archaeological objects were sought from the National Museum of Ireland.

References to other sites excavated as part of the N9/N10 Phase 4: Knocktopher to Powerstown are referenced throughout this report only by their site name e.g. Paulstown 1. A list of these sites and details including director's name and National Monuments Excavation Reference Number can be referenced in Appendix 4.

Final Report Date Ranges

The following date ranges for Irish prehistory and medieval periods are used for all final reports for the N9/N10 Phase 4: Knocktopher to Powerstown excavations.

Mesolithic: 7000–4000BC
Neolithic: 4000–2500BC
Early Bronze Age: 2500–1700BC
Middle Bronze Age: 1700–1200BC
Late Bronze Age: 1200–800BC
Iron Age: 800BC–AD500
Early medieval period: AD500–1100
Medieval period: AD1100–1600
Post-medieval: AD1600–1800

Source:
Carlin, N., Clarke, L. & Walsh, F. 2008 *The M4 Kinnegad-Enfield-Kilcock Motorway: The Archaeology of Life and Death on the Boyne Floodplain.* NRA Monograph Series No. 2, Wordwell, Bray.

2 EXCAVATION RESULTS

The site was situated in undulating pasture land on a slight gravel rise with panoramic views of the surrounding countryside. A stream was located to the south; it flows from the hills in the north-west towards the south-east where it meets the River Barrow which travels on a north-south axis. There are hills to the north and north-west, these span southwards along the west. There are also some low lying hills visible to the east. The peak of Brandon Hill is obvious to the south and the Blackstairs Mountains are also evident in the distance to the south-east. There is a large farm house and out buildings located immediately to the north-east. Tomard Lower 1 is visible *c.* 100m to the north-east and Cranavonane 2 is located *c.* 500m to the south-west. There is an earthwork (CW012–039) located *c.* 600m to the south south-west and there is a holy well (CW012–067) located *c.* 800m to the north.

2.1 PHASE 1 Natural Drift Geology

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C2	N/A	N/A	N/A	N/A	Yellow/brown/red clay	Subsoil

The subsoil consisted of yellow/brown/reddish clay.

2.2 PHASE 2 Archaeological Features

2.2.1 Cereal drying kiln C5

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C5	N/A	1.35	0.75	0.22	Oval shaped feature	Cut of kiln
C6	C5	1.18	0.75	0.08	Dark brown silty clay with a red hue	Fill of kiln
C7	C5	0.85	0.69	0.05	Yellow brown silty clay with charcoal	Ash layer in kiln
C8	C5	0.90	0.60	0.03	Black friable layer	Thin charcoal layer
C9	C5	1.40	0.75	0.11	Red friable silty clay with charcoal	Burnt clay at base of kiln

Finds: None

This small oval-shaped kiln C5 had gradually sloping sides and a concave base (Figures 4–5; Plates 1–2). It contained a substantial oxidised clay layer C9 at its base with thin deposits of charcoal C8 and ash C7 over-laying it. Charred seeds were also recovered from the upper fills of the kiln, suggesting it probably functioned as a small cereal-drying kiln.

Charcoal analysis of fills C6/7/8/9 (fill of kiln C5) indicated a predominance of hazel (*Corylus avellana*) and willow (*Salix sp.*) which represents fuel burnt within this feature and may also represent the remains of a light structure or platform which had burnt down within the kiln (Lyons, Appendix 2.1).

A small fragment (0.07g) of hazel was chosen from the fill of kiln C5 for AMS dating and returned a result of 2028±24 (UBA 12251). The 2 Sigma calibrated result for this was 104BC–AD50 (QUB, Appendix 2.4) dating this feature to the middle Iron Age.

Plant remains analysis was carried out on a sample retrieved from kiln fills C6/7/8/9 and a large quantity of cereal grains were recovered. More than 50% of these were labelled indeterminate cereal grains as they were not identifiable to species or genus. Of the identifiable material, all was identified as barley (*Hordeum* species) and 95% was identified as naked barley grains (*Hordeum vulgare* L.) var. nudum (Johnston, Appendix 2.2).

Hulled barley is often seen as more common than naked barley in Ireland (e.g. Johnston 2007b, 15) but the growing body of archaeobotanical data from Ireland has

demonstrated that naked barley is also very common (see the short discussion in McClatchie 2007, 65) (Johnston, Appendix 2.2).

2.2.2 Oval Pit

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C4	N/A	1.00	0.91	0.30	Sub oval in shape with a concave base	Cut of pit.
C10	C4	0.98	0.60	0.18	Dark brown silty clay with charcoal	Fill of pit
C11	C4	0.98	0.31	0.15	Mid brown silty clay with charcoal	Fill of pit

Finds: None

This sub-oval-shaped pit had a moderate amount of charcoal with a frequent amount of small to medium-sized sub angular stones within its fills (Figures 4–5; Plate 3). It was located approximately 14m north of the kiln. It possibly functioned as a waste pit, but any definitive association with the kiln, given the distance between them, was not established.

Analysis of charcoal retrieved from the fill C10 (fill of pit C4) indicated a predominance of alder (*Alnus glutinous*), ash *(Fraxinus excelsior)* and willow (*Salix sp.*) and charcoal analysis of fill C11 (also fill of pit C4) indicated a predominance of oak (*Quercus*). Pit C4 is likely to have functioned as a refuse pit or dumping ground for nearby firing activities and the wood composition recorded may denote two phases of dumping (C10) and (C11) (Lyons, Appendix 2.1).

A total of 9 burnt bone fragments were identified within C10 (the fill of pit feature C4), three of which were identified as pig (*Sus*) rib but due to the small size and poor preservation of the remaining six bone fragments, it was not possible to identify them to animal species (McCarthy Appendix 2.3).

A small fragment (0.1g) of ash was chosen for AMS dating and returned a result of 2122±24 (UBA 12252). The 2 Sigma calibrated result for this was 341–54BC (QUB, Appendix 2.4) dating this feature to the middle Iron Age.

2.3 PHASE 3 Topsoil

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C1	N/A	N/A	N/A	0.35	Mid-brown, stoney clay	Topsoil

Finds

Context	Find No	Material	Period	Description
C1	E3731:001:1	Glass	Modern	Glass found close to C4

The topsoil consisted of mid brown stoney clay and sealed the entire site.

3 SYNTHESIS

The synthesis presents the combined results of all of the archaeological analysis carried out at Cranavonane 3. 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 – compiled by Michelle Brick

3.1.1 The General Landscape

The topography of the region through which the route passes is generally flat with an average height of 70m O.D. The southern periphery of the route is bordered by Kilmacoliver (261m) and Carricktriss Gorse (314m), with Slievenamon (721m) further west. The Slieveardagh hills (340m) are visible on the western horizon in the south of the route and with the exception of Knockadrina Hill (140m), the enclosed landscape is made up of minor undulations. In the centre of the route Freestone Hill (130m) and Knocknagappoge (334m) further north are the significant uplands. A number of hills and mountains are visible in the distance to the east and west of this area of the landscape but the topography remains generally flat. To the north the Castlecomer Plateau influences a rise in the overall topography of the region. This expanse of terrain stretches along the north-east margins of Kilkenny, crosses the county border into Carlow and stretches northwards into Laois. This plateau consists of a variety of hills and peaks including Mountnugent Upper (334m), Baunreagh (310m), Knockbaun (296m), Brennan's Hill (326m) and Fossy Mountain (330m). These hills contain seams of anthracite coal as a result of millions of years of compression, and consequently Shales and Sandstones were formed which are evident throughout the plateau. Mining in the region began in the 17th century, continued for over 300 years and it is for what Castlecomer is best known. According to the Environmental Protection Agency soil maps of Ireland, the underlying bedrock of the entire region primarily consists of Carboniferous Limestone. However there is also a small amount of surface bedrock, sands, gravels, shales and sandstone Tills present along the route. The soil cover of the region is primarily composed of Grey Brown Podzolics, Renzinas and Lithosols. Additional soil types also present along the route include Brown Earths, surface Water Gleys and Ground Water Gleys.

The prevailing water courses within the landscape of the N9/N10 Phase 4 are the Rivers Nore and Barrow. The River Nore rises on the east slopes of the Devil's Bit in Co. Tipperary and flows eastwards through Borris-in-Ossory and then south through Co. Kilkenny, passing through the towns of Durrow (Laois), Ballyragget, Kilkenny, Bennettsbridge and Thomastown to join the River Barrow upstream of New Ross, Co. Wexford. It is 140 kilometres long and drains a total catchment of 1572 square kilometers and runs through the central and southern sections of the route. In the south of the route three main tributaries of the River Nore are evident. The Kings River flows east through Callan and Kells. It is joined by the River Glory which meanders on a north-south axis towards the western margins of the route landscape and the Little Arrigle River flows along the southern fringes. These rivers are flanked by low-lying valleys that are characterised by wet, marshy land. The condition of the soil improves further north beyond the King's River where the influence of these waterways declines. In the northern area of the route the River Dinin is a tributary of the River Nore flowing south-west from Brennan's Hill through the Castlecomer Plateau. The Plateau is the tableland that is the watershed between the Rivers Nore and Barrow (Lyng 1984). The River Barrow is the second longest river (193 kilometres) in Ireland after the River Shannon. It rises in the Slieve Bloom Mountains in Co Laois and flows east across bogs and lowlands and then turns south into the lowland immediately east of the Castlecomer Plateau. It passes through

Portarlington, Athy, Carlow, and Graiguenamanagh and runs through northern section of the route. It is joined by the River Nore at New Ross. The Maudlin River is the notable tributary of the River Barrow within the landscape of the route and flows east from Old Leighlin, with minor tributaries of it flowing through Banagagole. There are also streams and minor watercourses present throughout the entire landscape and these waterways would have been a valuable resource to past communities and would also have had a major influence on settlement and the surrounding land use.

The physical landscape through which the N9/N10 Phase 4 passes can be divided into three principal areas defined by the main rivers and their catchments. The southern area is located in the undulating landscape on the western flanks of the Nore Valley. The central area is dominated by the fertile watershed between the Barrow and Nore systems in the hinterland of Kilkenny City. The northern area is located on the western flanks of the Barrow Valley overlooked by uplands to the north and west. Cranavonane 3 is located in the northern landscape area.

3.1.2 The Northern Landscape

The northern landscape of the N9/N10 crosses the border from Kilkenny into Carlow and traverses the western side of the River Barrow; the Blackstairs Mountains, which are of granite formation, are located to the east of the Barrow. It includes 50 sites discovered during the Phase 4 excavations stretching from Rathcash 1 northwards to Tomard Lower 1. This northern landscape is overlooked to the west by the Castlecomer Plateau, and the excavated sites are all situated on contours of 50–100m OD. From the south-west of the Barrow, and encroaching into the northern landscape, the underlying limestone is dolomitized and consequently the permeability has been increased. The glacial drift comprises slightly sandy (20–60%) slightly gravely clays with a moisture content of 10–20%. There is therefore significantly less sand but higher moisture content than in the southern and central landscapes. This moisture occurs in the wetter deposits in the top 1–2m before ground level in localised areas with silty sand and gravel lenses indicating a high water table. To the east of the River Barrow, localised silty, laminated clays and peat occur. Soft ground was noted in the river's floodplain. The area is also classified as a minor aquifer in the Kilkenny Groundwater Protection Scheme (Buckley & Fitzsimmons, 2002) due to these thick sand and gravel deposits. Progressing northwards, the views become more expansive, and the rising high ground of the Castlecomer Plateau (50–300m OD) bounds the distant landscape. This plateau consists of a variety of hills and peaks, which contain seams of anthracite, the focus of coal mining in the region from the 17th century..The Blackstairs Mountains (735m) are visible on the horizon to the south-east, and most obvious of these is the peak of Mount Leinster (795m). There are impressive views from these plateaus and hills especially to the south, east and west over the Barrow and Nore Valleys.

The prevailing watercourse of this region is the River Barrow which travels north-south through the landscape. The Maudlin River is a tributary of the River Barrow and flows from the west through Old Leighlin; minor tributaries of this river flow through Bannagagole, directly north of Moanmore, and the River Dinin is a tributary of the River Nore which travels south-west from Brennan's Hill through the Castlecomer Plateau. The suffix 'comer' signifies a meeting of the rivers; it also signifies any deep gripe, such, for instance, as the channel formed by a mountain stream (Carrigan 1905). From the hinterland of Kilkenny and the confluence of the Nore and Barrow the Monefelim River contributes to the occurrence of wet grassland and broadleaf woodland. The narrow tributaries of the River Barrow, including the Monefelim River, as well as the Maudlin River, flow from the higher, steep, escarpment located to the west. Subsoils in this area consist of undifferentiated alluvium and soils of mineral alluvium. The route crosses into County Carlow where

at Moanmore (meaning 'great bog') a variety of archaeological features have been recorded. At the most northerly point of the N9/N10 the land is again characterised by its views; here they include the Barrow Valley, Mount Leinster, Brandon Hill, and the Blackstairs Mountains.

3.1.3 Site Specific Landscape

The site was situated in undulating pasture land on a slight gravel rise with panoramic views of the surrounding countryside. A stream, flowing from the hills in the north-west to meet the River Barrow, was located to the south. There are hills to the north and north-west, these span southwards along the west. There are also some low lying hills visible to the east. The peak of Brandon Hill is obvious to the south and the Blackstairs Mountains are also evident in the distance to the south-east. There is a large farm house and out buildings located immediately to the north-east. Tomard Lower 1 is visible *c*. 100m to the north-east and Cranavonane 2 is located *c*. 500m to the south-west. There is an earthwork (CW012-039) located *c.* 600m to the south south-west and there is a holy well (CW012-067) located *c.* 800m to the north.

3.2 The Archaeological Landscape

As part of the general research relating to sites along the scheme and the specific research relating to Cranavonane 3, the known archaeology within the surrounding landscape was assessed in order to establish the level and type of activity in the surrounding area in the past. This included a review of information from the Record of Monuments and Places, previous excavations and other relevant documentary sources including mapping and other sites excavated as part of the N9/N10 Phase 4 scheme. The excavated archaeology at Cranavonane 3 has been identified as being Iron Age in date.

3.2.1 The General Iron Age landscape of the Scheme – compiled by Michelle Brick

As with wider settlement patterns in Ireland, direct evidence for Iron Age (800BC–AD500) domestic habitation was not identified, although several furnaces, kilns and ringditches date to this period and attest to an Iron Age presence in the area. It is possible that some smaller Iron Age ringditches were in fact structural, rather than funerary. Evidence for Iron Age domestic settlement activity remains indirect and peripheral in Kilkenny and Carlow, and in Ireland as a whole.

The Southern Landscape

Direct evidence of Iron Age activity in the southern landscape of the N9/N10 Phase 4 is limited. There is a marked absence of hillforts from south Kilkenny but this does not necessarily infer absence of settlement (Gibbons 1990, 20). A small number of features produced Iron Age dates in this landscape as a result of the N9/N10 Phase 4 excavations. A posthole dating to this period (165BC–AD16; UBA 10984) was excavated at Baysrath 2, and belongs to a possible structure indicating potential domestic settlement in the region. At Tinvaun 2 a possible hut structure was identified which consisted of four truncated slot-trench-like pits, a posthole and a shallow, roughly central pit in the interior of the area. Dates returned for this possible structure have indicated that it was in use during the Iron Age period (AD5–124; UBA 12169). There was also some metalworking activity on site and this structure may have been associated with it. Further to this, a posthole and a hearth excavated at Danganbeg 1 also dated to the Iron Age (762–416BC and 41BC–AD55; UBA 14025 and UBA 14024 respectively). No funerary features belonging to the Iron Age were excavated as part of the present Phase 4 in the southern landscape. However, some metal working activity in the form of slag pits/furnaces and funerary activity in the form of a ringditch has been excavated at Baysrath directly to the south of the

present excavations and have been dated to the Iron Age period (Channing 2007). Three circular structures excavated at this site have also been dated to this period (AD60–131, AD25–128 and 88BC–AD53; UBA 10684, UBA 10685 and UBA 10691 respectively) indicating a strong Iron Age presence in this area (*ibid.).* A ditch dating to the Iron Age (39BC–AD74; UBA 10993) was excavated at Tinvaun 1; burnt mound activity associated with the Bronze Age was also excavated at this site and this ditch relates to a later phase of activity at the site. At Knockadrina 2 (51BC–AD78; UBA 12178) an Iron Age furnace was excavated and at Stonecarthy West 1 a possible trough also yielded an Iron Age date (771–539BC; UBA 12174), however other features associated with a burnt mound on the site returned Bronze Age dates.

The Central Landscape

As with the southern landscape there is no direct evidence for Iron Age settlement although there are many early medieval RMP sites in this area, the majority of which are ringforts and enclosure sites, such as the ringforts recorded at Woolengrange (KK024-079 & KK024-082) and the enclosures at Carran (KK024-021001&2) . Iron Age activity in the county is represented by the Hillfort at Freestone Hill where a defensive hillfort and inner enclosure (KK020-018002) was built encircling the hill-top (Gibbons 1990, 18), re-using the site of an earlier burial cairn (KK020-018001). The site was then re-occupied *c.* AD300 (Raftery 1969). Another possible Iron Age hillfort is located at Cotterallsrath located to the west of the southern end of this central landscape. Directly to the north-east of this site and located four miles south of Kilkenny City are the remains of a linear earthwork at Grevine West (Gibbons 1990, 20), also indicating an Iron Age presence in the region. Additionally, excavations were carried out at two ringforts in the townland of Dunbell; Dunbell 6 in 1972 and Dunbell 5 (KK024:010) in 1990 (Foley 1974; 2006; Cassidy 1991). The ringfort settlement at Dunbell 5 in particular produced dates from the Bronze Age to the eighth–10th centuries AD including evidence of Iron Age occupation.

Two clusters of Iron Age activity were noted from the N9/N10 excavations within the central landscape, at Danesfort and at Kilree and Holdenstown. These sites exhibited evidence for funerary activity and no evidence for domestic settlement was uncovered within this central landscape. At Danesfort 13 the primary fill of a ringditch returned a radiocarbon date of 503–384BC (UBA 10999) and was considered to be associated with two similar ringditches excavated at the neighbouring site of Danesfort 12. A fine glass bead found within a pit at Danesfort 13 also indicated that Iron Age activity continued in the Danesfort area, confirming the longevity of Danesfort as a focus for prehistoric funerary activity and although the area continued to be occupied in the early medieval period the focus then shifted towards settlement. Iron Age activity was excavated at Kilree 4, a site which contained a probable token cremation burial within a double ringditch (171 BC–AD 4), which was located on flat, gravely ground that overlooked the River Nore and its floodplain. At Holdenstown 1, three ringditches of possible Iron Age date were excavated. The largest was penannular in plan and had an undug, east-facing causeway. The two best preserved ringditches had evidence of re-cutting which may have been a symbolic act of redefining the burial monument. The primary phase has been interpreted as representing funerary feasting while the secondary phase consisted of burial possibly dating to the late Iron Age. Both ringditches were subsequently re-cut and were backfilled with material which included burnt bone, charcoal, seeds, and animal bone. The quantity of cremated bone is indicative of token cremation mixed with pyre debris. Although Ringditch 3 was heavily truncated, it also contained evidence of token cremation. The evidence thus far is indicative of burial potentially in the Iron Age and the site was later re-used as an inhumation cemetery known as a ferta, during the early medieval period. A shallow, north-east/south-west linear ditch spanned the entire width of the site at Holdenstown 1. The precise function of this

ditch is unknown; however, its length and the fact that no return was identified suggest that it may have been a boundary ditch. It is possible that it is broadly contemporary with the burials within Ringditch 2, as these burials followed the same alignment of this ditch and there was no truncation. The ditch has been dated to the Iron Age period (168–3BC; UBA 13108). It is then possible that the burials associated with Ringditch 2 and with this ditch were placed either inside or outside the boundary; both of which suggests a significant symbolism.

In Danesfort 12 a furnace had evidence of reddened sides and a burnt and blackened rim but the base was not scorched. The fills contained large quantities of charcoal and slag. It is possible that this activity was contemporary with the Iron Age funerary activity recorded on site. Metallurgical activity was also recorded at Danesfort 13 and included two smelting furnace pits, a metalled surface, three waste pits, and an occupation deposit. This activity may also have been contemporary with Iron Age funerary activity also recorded on site. At the multi-period site of Danesfort 5 a metalworking area was identified and included several pits and deposits. Of these pits one returned an Iron Age date of 786–543 BC (UBA 12192). A kiln excavated at Danesfort 5 also produced Iron Age dates ranging between 169BC and AD50, (UBA 12189–91). Other features at this site were dated to the late Bronze Age period and the Iron Age activity may indicate a continuity of settlement at the site. At Holdenstown 2 a total of five kilns were identified with one dating to AD21–203 (UBA 13111). Both Danesfort 2 and Holdenstown 4 returned Iron Age dates from features associated with burnt mound activity (AD503–384; UBA 11000, 765–420BC; UBA 13114).

The Northern Landscape

The northern landscape of the N9/N10 Phase 4 also contained Iron Age evidence. The aforementioned Freestone Hill (KK020-018) is located directly to the south of this landscape and two additional hillforts can also be located in the north of the county. Clomantagh (KK008-124002) overlooks Johnstown in north-west Kilkenny and similar to Freestone Hill, the site was originally used in the Bronze Age as a funerary complex (Gibbons 1990, 18). A linear earthwork has also been recorded at Woodsgift (Gibbons 1990, 20) and is located directly to the south of this site. The other possible hillfort in the region is recorded at Tooremore or Carndubh to the east (*ibid.*). This hillfort which is not shown on the Ordnance Survey maps is situated on Corrandhu Hill, two miles east of Ballyragget, straddling the townland boundary between Toore More and Donaghmore (Condit and Gibbons 1988, 49). Further to these, located along the Kilkenny-Carlow border is a linear earthwork known as the Rathduff Trench (KK026-006). It ran for over three miles from the River Barrow at Duninga, in a north westerly direction to the foothills of the Castlecomer plateau above Shankill (Gibbons 1990, 20). A portion of this linear earthwork was excavated at Shankill 1 and consisted of a U shaped bank with a ditch.

Excavations in the northern landscape of the N9/N10 produced a small amount of domestic settlement evidence. The fill of a stakehole associated with a possible structure at Moanduff 1 produced an Iron Age date of AD251–376 (UBA 13124); the site also had evidence of occupation in the Bronze Age which implies that the site may have been used throughout both periods. Radiocarbon dating for Rathcash East 1 also indicates use of the site during the Iron Age period. The excavated features included a possible structure that may be inferred as a ringditch as a result of the middle Iron Age date retrieved from its fill (38BC–AD73; UBA 12221) and an associated rubbish pit (37BC–AD123; UBA 12220). Excavations in the northern landscape of the N9/N10 did not produce any evidence for Iron Age funerary activity. However ephemeral Iron Age activity was discovered at a number of sites in the form of metal working and burnt mound activity. At Rathcash East 3 a large keyhole-

shaped furnace that dated to the Iron Age (160BC–AD0; UBA 14032), aligned northeast–southwest was excavated along with six post-pits that may have supported a shelter around the west side of the furnace. The post – pits had a rectangular arrangement, being open on the east (furnace) side. The furnace had 18 fills, with the majority containing significant amounts of charcoal and frequent slag. Some of the post-pits contained charcoal, burnt clay and slag. One of the post-pits has been dated to 362–200BC (UBA 14033). A kiln and pit excavated at Cranavonane 3 have been dated to 104BC–AD50 (UBA 12251) and 341–54BC (UBA 12252) respectively. In addition to these features a pit excavated at Jordanstown 1 returned a date of 382–206BC (UBA12233) and a pit at the multi-period site of Moanduff 2 retrieved a date of AD140–385 (UBA 12260). Features associated with burnt mound activity dating to this period were excavated at Rathcash 2 where the fill of a trough dated to 344–55BC (UBA 12219) and at Kellymount 2, where a waterhole has been dated to AD236–380 (UBA 14041). The fill of a trough at Kellymount 3 also returned a date of 751–409BC (UBA 14043).

Conclusion
The presence of the Iron Age ringditches along the N9/N10 Phase 4 and the number of sites displaying industrial activity dating to this period confirm the presence of an Iron Age community in the region. The possible structure at Rathcash East 1 may also be indicative of an Iron Age settlement site, further demonstrating Iron Age activity in the locality. The presence of three hillforts in north Kilkenny suggests that it was an area of considerable importance during this period (Condit and Gibbons 1988, 52). The lack of excavated domestic settlements along the route is not indicative of a sparse population at the time rather they were not located along the corridor of the N9/N10 route-way and have yet to be discovered.

3.2.2 The Site Specific Archaeological Landscape of Cranavonane 3

There are no recorded monuments in the immediate vicinity of Cranavonane 3. A holy well (CW012-067) is recorded *c*. 600m to the north and to the south-east a ring barrow (CW012-043) is recorded *c*. 700m away. Further to the south-east a mound site (CW012-042) is recorded *c.* 750m away and to the south a possible enclosure site (CW012-041) is recorded *c*. 900m away. An earthwork (CW012-039) is recorded *c*. 450m to the south south-west, and an enclosure site (CW012-083) is recorded *c*. 700m to the south-west. Ecclesiastical remains (CW012-022) are recorded *c*. 600m to the north north-west and beyond these two enclosures (CW012-098–099) are recorded *c*. 800m away.

At Cranavonane 3 a small oval shaped kiln and pit dating to the middle Iron Age period were excavated. One site was excavated to the north-east of Cranavonane 3, as part of the N9/N10 Phase 4: Knocktopher to Powerstown works. Tomard Lower 1 was located *c*. 250m away and three pits excavated to the north of the site returned a late Neolithic-early Bronze Age and an early Bronze Age date. A burnt mound and associated features were also excavated at the site and this activity has been dated to the early Bronze Age.

A number of sites were also excavated to the south-west of Cranavonane 3, as part of the N9/N10 Phase 4: Knocktopher to Powerstown works. Cranavonane 2 was located *c*. 350m away and during testing a deposit of charcoal-rich material with heat-shattered stones was identified as belonging to a small burnt mound however no further excavation or recording was carried out at this site due to flooding. Cranavonane 1 was located *c*. 700m to the south-west and a small burnt spread which sealed a large rectangular trough dating to the middle–late Bronze Age period was excavated. Coolnakisha 2 was located *c*. 1.1km away and one possible cremation pit, a possible hearth, a charcoal-rich pit, two possible postholes, and

numerous possible pits were excavated at this site. Dates returned for the charcoal rich pit and the possible hearth assign these features to the late Neolithic period and the possible cremation pit has been dated to the middle Bronze Age period indicating this site had more than one phase of occupation.

3.3 Typological Background of Cereal Drying Kilns.

Cereal-drying kilns were used for a variety of purposes, but were mostly related to the drying of cereals and other crops. In Ireland the two basic purposes for which they were constructed seem to have been to dry grain and to harden it prior to grinding (O'Sullivan and Downey 2005, 32). The Irish 'corn-drying kilns' are frequently keyhole or dumb-bell shaped (*ibid. 33*). Oval- and sub-oval-shaped kilns are dated to the Iron Age and these are precursors for slightly later figure-of-eight and dumbbell types (Kinsella 2007, 4). Figure-of-eight and dumb-bell kilns were early medieval (Monk and Kelleher 2005, 105–6; Kinsella 2007 6–7) and keyhole-shaped kilns functioned from approximately ninth or 10th century to the late medieval period (Monk and Kelleher 2005, 105; Kinsella 2007, 7). The basic kiln would comprise four main structural components: a *bowl*; *flue*; *stoke-hole*; and *drying platform* (*ibid.*). A fire would have been set at the *stoke hole* (which was either a natural depression or cut) at the mouth of the *flue*. This would be where the fire was burned to effect the drying (*ibid.*). The *flue* extends from the *bowl/drying platform*. The *drying platform* overlay the *bowl* and typically consisted of heavy timber supports overlain with wattles, carrying a layer of straw and/or straw mat, through which the heat was able to pass through from below to the grain/cereal (*ibid.*).

3.4 Summary of the Excavation Results

The excavation identified a small oval cereal drying kiln and a pit. It is not clear if the two features are directly related although their relative proximity to each other and the lack of any other features on the site suggests they are most likely associated.

3.5 Summary of the Specialist Analysis

A number of specialists provided analysis of samples and artefacts 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 and Wood Species identification

Kiln C5 contained hazel and willow, which represents fuel, burnt within this feature and may also represent the remains of a light structure or platform which had burnt down within the kiln. Pit C4 is likely to have functioned as a refuse pit or dumping ground for nearby firing activities and the wood composition recorded may denote two phases of dumping.

Analysis of Plant Remains

A large quantity of cereal grains were recovered from the kiln C5 and the majority of these, more than 50%, were not identifiable to species or genus (labelled as 'indeterminate cereal grains'). Of the identifiable grains, all were identified as barley and most of these (95%) were naked barley. Naked barley is easier to process than the hulled variety of barley, since there is less chaff to remove from the grain before consumption.

Animal Bone Analysis

Nine burnt bone fragments recovered from C10, the loosely compacted brown silty fill of pit feature C4, were submitted for examination. A total of 6 (66.7%) were not possible to identify to species due to small fragment size and poor preservation of the bone. The remaining 3 fragments (33.3%) were identified and divided into species

type. The burnt bone assemblage contained bones from a single recognisable species of pig/*sus*.

Radiocarbon Dating

Two samples were sent for AMS radiocarbon dating.

A sample of hazel charcoal from kiln fills C6, C7, C8 and C9 returned a 2 sigma calibrated date of 104BC–AD50 (UBA 12251).

A sample of ash charcoal from pit fill C10 returned a 2 sigma calibrated date of 341–54BC (UBA 12252).

4 DISCUSSION AND CONCLUSIONS

4.1 Discussion

The site consisted of a small oval-shaped kiln. In addition, a small pit was identified a short distance away which may have represented a waste pit. Both features were dated to the middle Iron Age.

The surrounding physical landscape is marginal and wet in places as evidence by the nearby burnt mound site at Tomard Lower 1 to the northeast and a burnt mound spread at Cranavonane 2 to the southwest. Indeed the excavation at the latter site was not able to proceed due to constant flooding. In this regard it is unlikely that cereal production was widespread in the vicinity and that the activity on the site is quite localised.

The surrounding archaeological landscape shows no recorded monuments in the immediate vicinity although there are a number of sites within 1km of Cranavonane 3 that may be broadly contemporary with the excavated Iron Age kiln and pit. In particular the ring barrow (CW012:043) may represent an Iron Age phase of activity. Excavations as part of the N9/N10 Phase 4 works identified some sites in the surrounding landscape but these were all dated to the Bronze Age and none produced Iron Age evidence. The lack of any definitive Iron Age evidence in the area makes the results of the Cranavonane 3 excavation somewhat unexpected. However, along the length of the N9/N10 Phase 4: Knocktopher to Powerstown, similar isolated Iron Age activity in the form of kilns, furnace and pits have been recorded at intervals. In some instances the features are located in close proximity to earlier monuments and sites, but also in apparent isolation, as with Cranavonane 3. No evidence was identified on the scheme for intensive Iron Age settlement and this suggests that the Iron Age community may have been quite dispersed. In north Kilkenny, at Kellymount 5, an almost identical site was excavated as part of the N9/N10 Phase 4 which consisted of a small oval cereal drying kiln and an associated small pit/posthole. Interestingly, the kiln was dated to 91BC–AD50, almost identical to that at Cranavanone 4. This could indicate that this type of isolated oval kiln is typical for the period.

The excavated kiln was oval in plan and Kinsella suggests that these are generally dated to the Iron Age. There is little doubt that it functioned as a cereal drier based on the volume of charred barley seeds recovered from its fill.

It is possible that the pit is broadly contemporary with the kiln. The calibrated radiocarbon dates for the two features do overlap in the range of 104–54BC, although the dates may also suggest that the pit is slightly earlier that the kiln. The lack of seeds within the fill of the pit could be interpreted as evidence that the two features were not related in terms of function as it would possibly be expected that a waste pit associated with the kiln would contain some charred seeds. The presence of a small amount burnt animal bone (pig) within the fill could be indicative of domestic waste, although it is also possible that this represents waste from a fire associated with the kiln as bone can often be used in conjunction with wood as a fuel.

4.2 Conclusions

The excavation at Cranavonane 3 has produced evidence of An Iron Age cereal drying kiln and associated pit. The site is important locally as there is little evidence of prehistoric activity in the immediate area and no firm evidence dating to the Iron Age. It is also of interest in the wider analysis of the distribution and function of Iron

Age sites in the area, for which there previously was little or no evidence. The site also provides evidence of middle Iron Age kiln technology.

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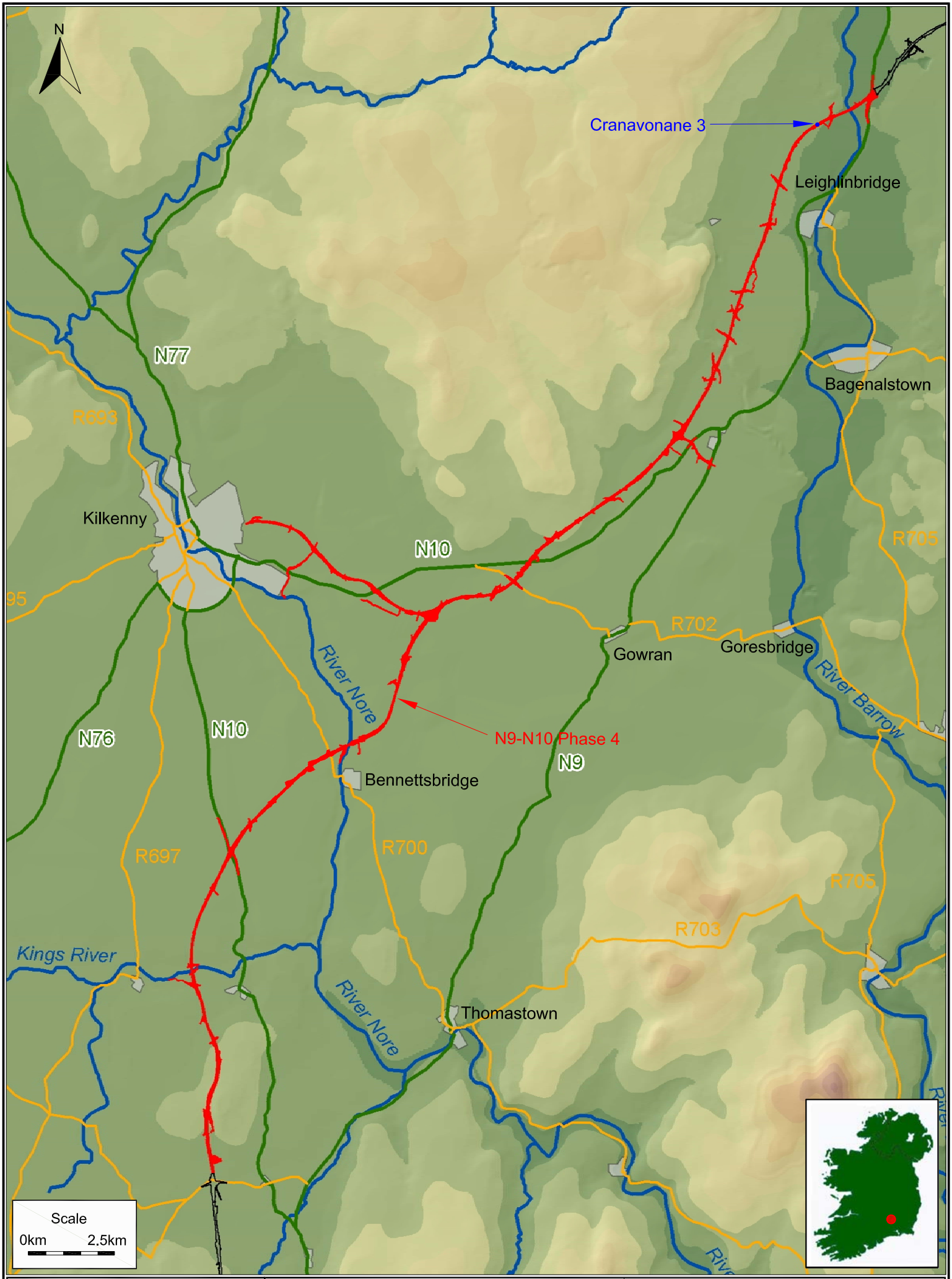

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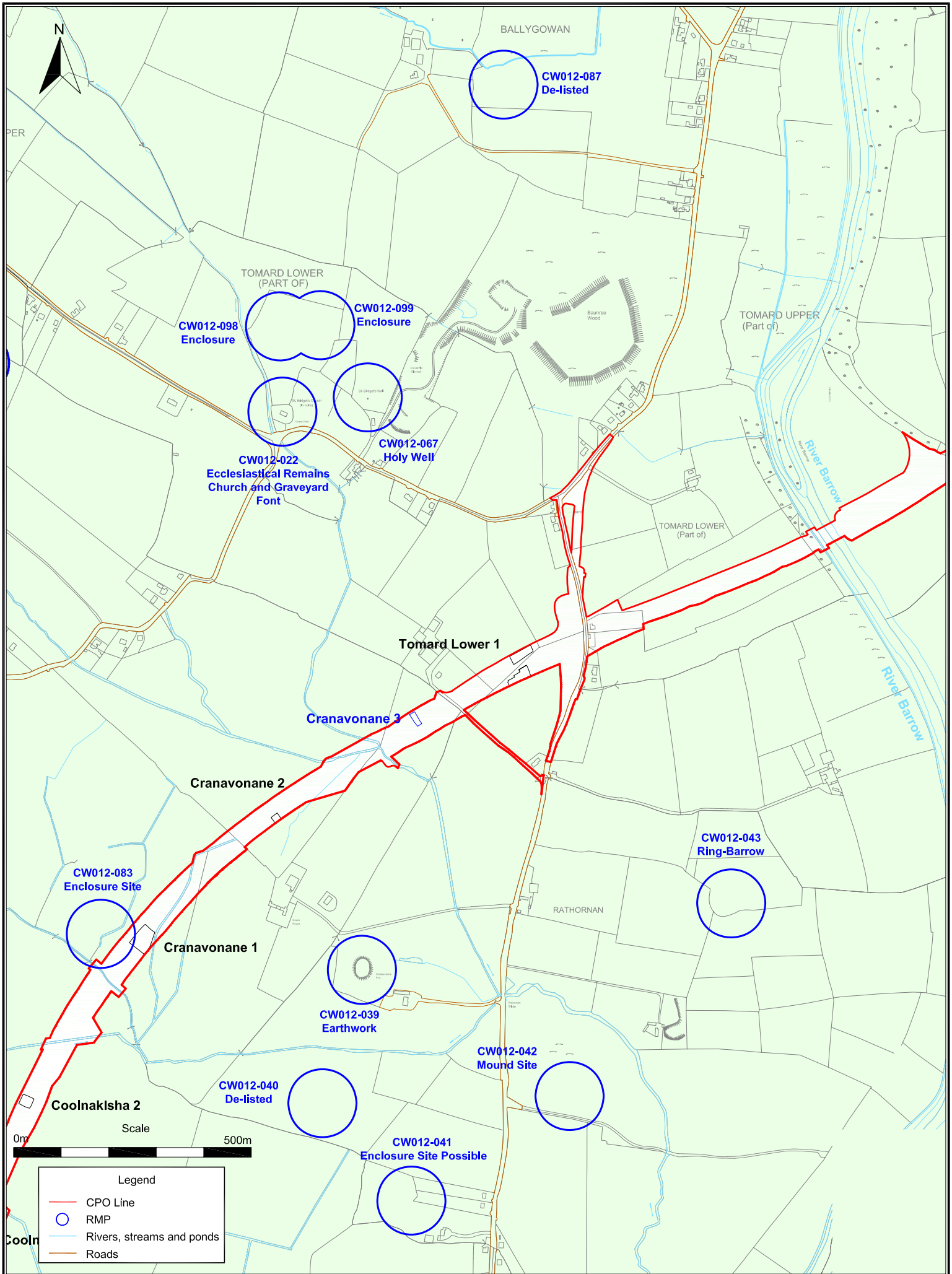
			Job No: J2432
			Figure No: 1



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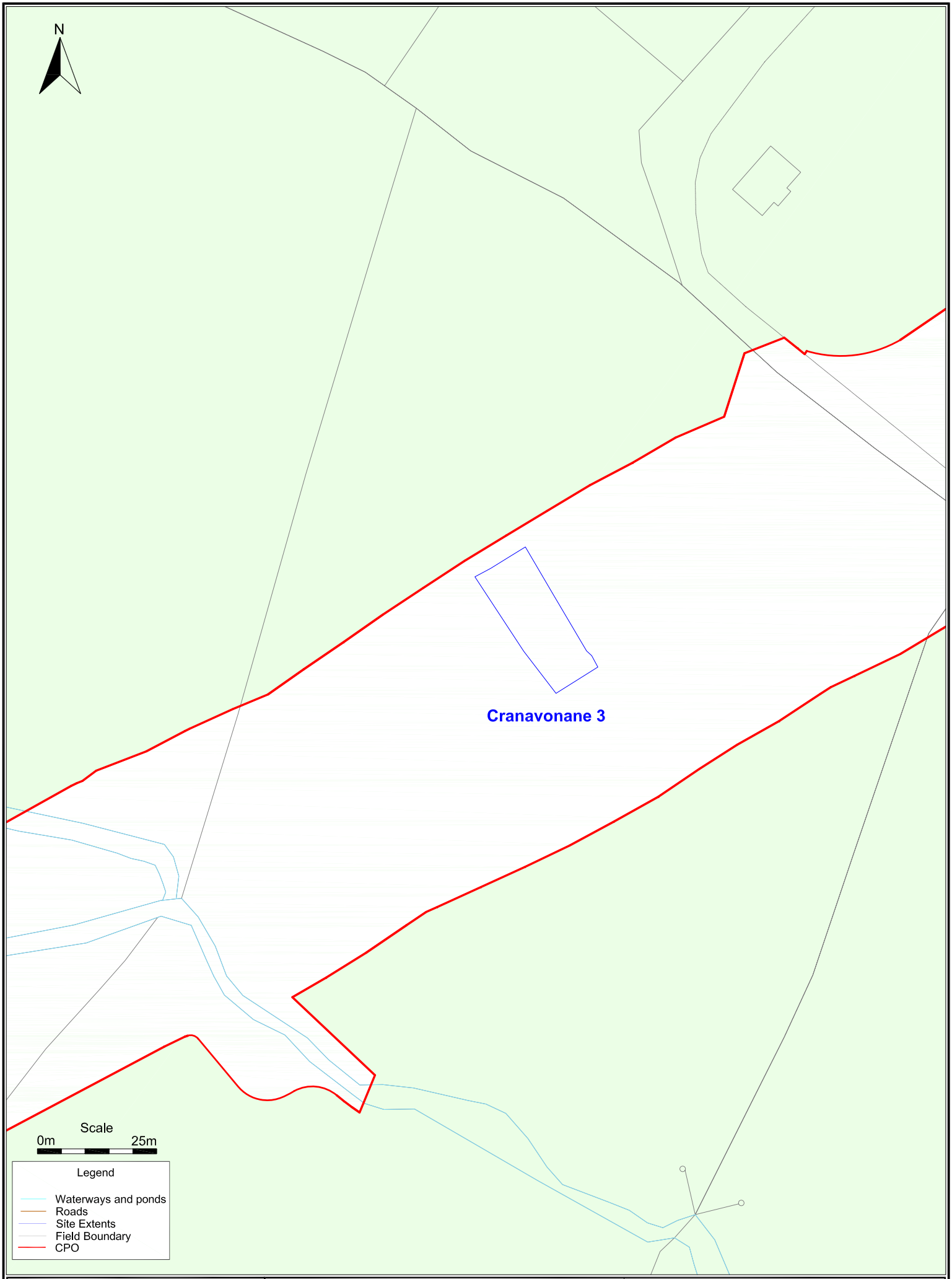

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Project:	N9-N10 Phase 4: Knocktopher to Powerstown
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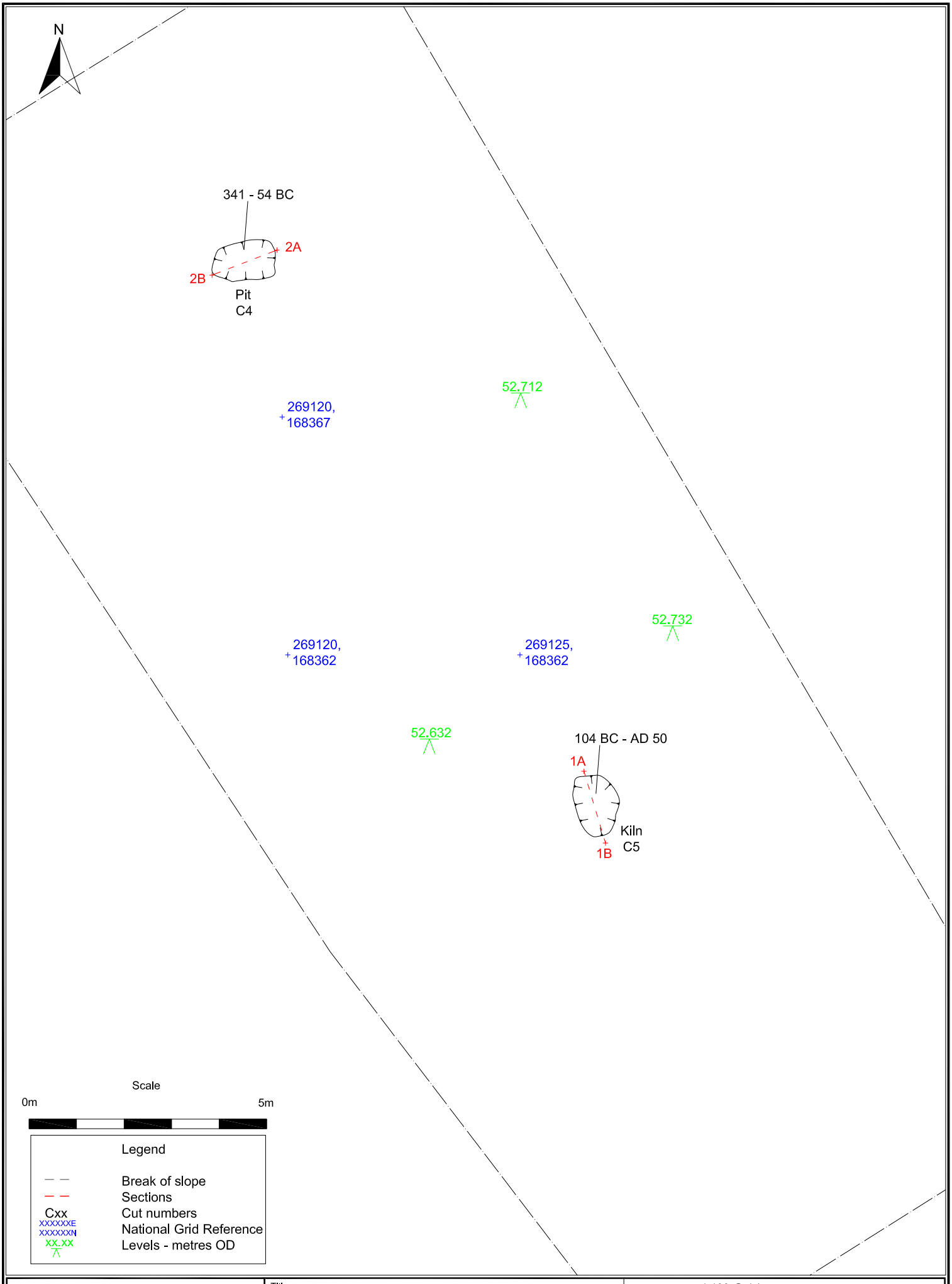
Job No:	J2432.1
Figure No:	3



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	Client:	Kilkenny County Council	Produced by: G Kearney
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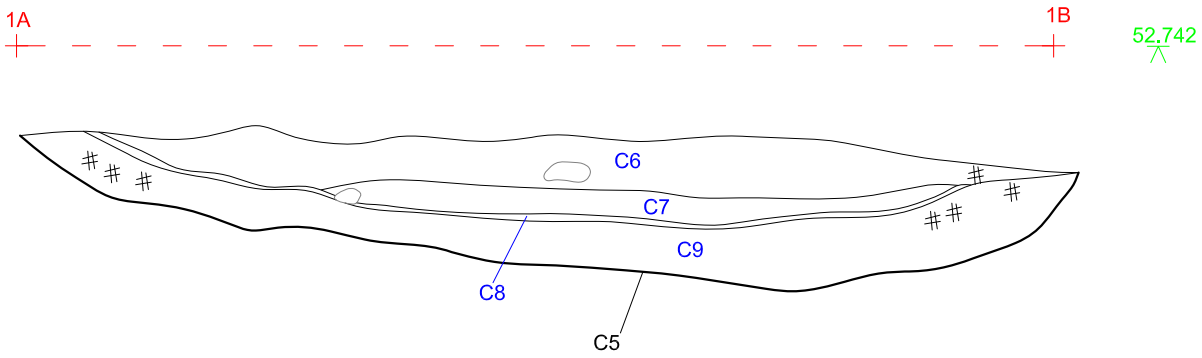
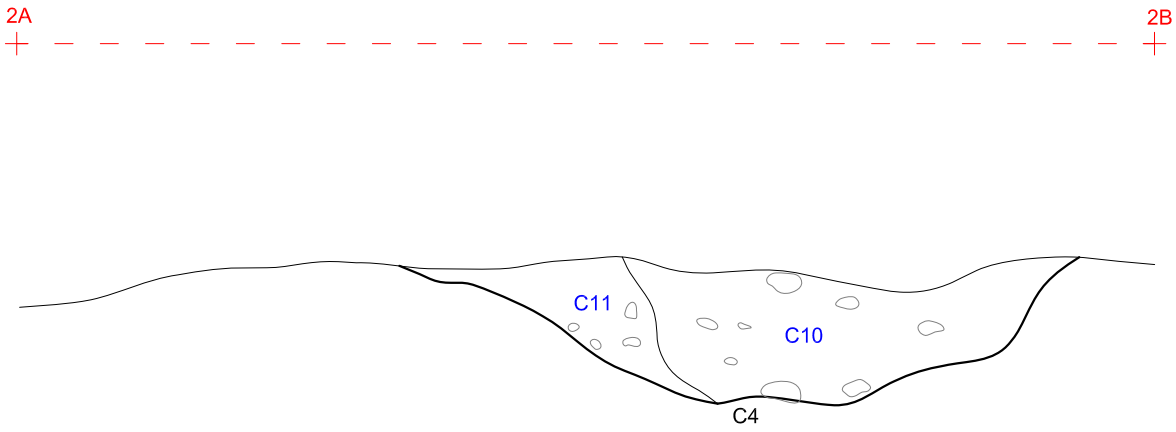
Southwest facing section of C5



Northwest facing section of C4



Scale

0m 0.5m

Legend

Cxx	Cut numbers
Cxx	Fill numbers
	Stone
#	Charcoal
xx.xx	Levels - metres OD

IAC Irish Archaeological Consultancy

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Project:	N9/N10 Phase 4: Knocktopher to Powerstown
Client:	Kilkenny County Council

Scale:	1:10 @ A4
Date:	26/05/10
Produced by:	G Kearney
Job No:	J2432.1
Figure No:	5

PLATES

Plate 1: E3731 Kiln C5, mid-excavation, facing SSW

Plate 2: E3731 Kiln C5, post-excavation, facing SSW

Plate 3: E3731 Pit C4, post-excavation, facing south

APPENDIX 1 CATALOGUE OF PRIMARY DATA

Appendix 1.1 Context Register

Context	Fill of	L(m)	W(m)	D(m)	Interpretation	Description	Context Above	Context Below
C1	N/A	N/A	N/A	0.35	Topsoil	Topsoil has average thickness of 0.35m mid-brown stoney clay	N/A	N/A
C2	N/A	N/A	N/A	N/A	Subsoil	Site located on a slight gravel rise. Subsoil comprises yellow, brown and red clay with large concentrations of gravel and sand layers	N/A	N/A
C3	N/A	0.10	0.15	0.08	Non archaeological	Small natural depressions filled with dark clay and some stones	C1	C2
C4	N/A	1.00	0.91	0.30	Cut of pit.	Sub oval N-S. Rounded corners. South side sharp, north side imperceptible, south side sloping, north side concave. Gradual break of slope of concave base.	C11	C2
C5	N/A	1.35	0.75	0.22	Cut of kiln	Oval in shape, rounded corners, sharp to slightly sloping top. Sides sloping on North and sharper on South. Gradual break of slope on sub-rectangular concave base	C9	C2
C6	C5	1.18	0.75	0.08	Fill of kiln	Bell shaped, loose compaction. Dark brown with a red hue. Silty clay with large particles. Small round pebbles and some larger sub-angular stones. Charcoal present.	C1	C7
C7	C5	0.85	0.69	0.05	Ash layer in kiln	Sub-circular in shape, loosely compacted. Yellow brown silty clay with small pebbles and small amount of charcoal	C6	C8
C8	C5	0.90	0.60	0.03	Thin charcoal layer	Sub-circular, loosely compacted, black friable fill with charcoal layer.	C7	C9
C9	C5	1.40	0.75	0.11	Burnt clay at bottom of kiln	Sub-circular, loosely compacted red, friable, silty clay, occasional fragments of charcoal	C8	C5
C10	C4	0.98	0.60	0.18	Fill of pit	Oval shape, loosely compact, dark brown silty clay, charcoal inclusions	C1	C11
C11	C4	0.98	0.31	0.15	Fill of pit	Oval shape, loosely compact, mid-brown silty clay, charcoal inclusions	C10	C4

Appendix 1.2 Catalogue of Artefacts

There were no artefacts recovered from the site.

Appendix 1.3 Catalogue of Ecofacts

During post excavation works specific samples were processed with a view to further analysis. Three soil samples totalling were taken from features at Cranavonane 1 and all three samples were processed by flotation and sieving through a 250µm mesh. The following are the ecofacts recovered from these samples:

Context #	Sample #	Feature type i.e. Structure A, hearth C45	charcoal	charred seeds	animal bone	burnt animal bone	human bone	metallurgical waste	Burnt clay
6,7,8,9	1	C5 Kiln	2.5g	2.1g					4.4g
10	2	C4 Pit	1.3g			2.7g			
11	3	C4 Pit	0.1g						

Appendix 1.4 Archive Index

Project: N9/N10 Phase 4 Knocktopher to Powerstown		
Site Name: AR143 Cranavonane 3		
Excavation Registration Number: E3731		
Site director: Ellen O'Carroll		
Date: 18.01.08		
Field Records	**Items (quantity)**	**Comments**
Site drawings (plans)	1 plan	1 post-ex plan
Site sections, profiles, elevations	1 section	
Other plans, sketches, etc.	0	
Timber drawings	0	
Stone structural drawings	0	
Site diary/note books		
Site registers (folders)	1	
Survey/levels data (origin information)		
Context sheets	11	
Wood Sheets	0	
Skeleton Sheets	0	
Worked stone sheets	0	
Digital photographs	10	
Photographs (print)	0	
Photographs (slide)	0	
Security copy of archive	Yes	Digital copy

APPENDIX 2 SPECIALIST REPORTS

Appendix 2.1 Charcoal and Wood Report – Susan Lyons

Client – Irish Archaeological Consultancy Ltd
Site Name- Cranavonane 3
Excavation number –E3731 AR143
County – Carlow
Job code –100.85
Author- Susan Lyons

Date –25/08/09

Introduction
Three charcoal samples were identified and analysed from excavations associated with two kiln features of potentially medieval date at Cranavonane 3 Co. Carlow as part of the resolution of the N9/N10 Kilcullen to Waterford Scheme, Phase 4B – Rathclogh to Powerstown. The site consisted of a small oval-shaped kiln of potentially medieval date and a pit of unknown date (O'Carroll & O' Mahony, 2009).

It is generally considered that the principle reason for charcoal analysis is the hypothesis that wood used as firewood will be collected from as close to a site as possible and as such can help to reflect the local wooded environment in the area. It is also likely that abandoned structural timbers or wood brought to the site for uses in construction works or other activities are also reused as firewood. The primary would represent the collected woods used as fuel at the site and go some way to interpreting the local woodland that grew in the vicinity of the site and possible changes to that woodland over time. This report serves as a summary report only for Cranavonane 3 and will later form part of an overall scheme-wide charcoal study for the N9/N10 (Lyons, *et al, forthcoming).*

Methodology (After IAC Ltd)
Processing

- A mechanical flotation tank using a pump and water recycling system is used for soil flotation
- The soil is washed using a 1mm mesh in the flotation tank and a 300 micron and 1mm sieve is used to catch floated material.
- The volume of all soil samples are recorded in litres using a measuring jug.
- The sample is then placed into the 1mm mesh in the flotation tank, the tank is then filled with water and the sample washed. Any large lumps of soil can be carefully broken down by hand, but the jets of water in the flotation tank gently clean the rest of the sample.
- Once the sample is clean (just stones, charcoal, artefacts remaining in the mesh) the tank is fill up with water and at this stage any floating material (charcoal, seeds etc) should flow over the spout and into the sieves.
- The retent is then gently poured into a labelled tray (containing site code, site name, sample number and context number) and place on a shelf to dry.
- The flots are securely packaged in tissue, labelled and hung up to dry. This prevents any loss of light material (seeds) which could result once the flots are dry and being moved (if they are dried on trays).
- Before washing a new sample all equipment used (measuring jugs, 1mm mesh, sieves etc) are thoroughly washed using clean water.
- The large black settling tanks (and water) are cleaned between every site, or if a large site is being processed, every 1-2 weeks.
- Any samples containing high clay content will be soaked in water for 1-2 days to aid the sieving process.

Charcoal identifications
Three charcoal samples from C6/7/8/9 (fill of kiln C5), C10 (fill of pit C4) and C11 (fill of pit C4) were selected for charcoal analysis.

The larger sized charcoal fragments (>3mm in width) are fractured to view the three planes [transverse, radial and tangential sections] necessary for microscopic wood identification. The wood species identifications are conducted under a binocular microscope using a trancident light and viewed at magnifications of 100x, 200x and 400x where applicable. Where possible the age and growth pattern of the wood

fragments is also recorded by studying the transverse section at a magnification of up to 40x.

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).

Quantifying charcoal samples can be difficult as many wood species can be affected by heat is different ways and hence become fragmented into an arbitrary number of fragments. Due to the potential for a very high number of charcoal fragments from the samples, a representative sample of 50 charcoal fragments (Keepax, 1988) are randomly chosen from larger samples for identification and analysis. In the case of smaller samples all charcoal fragments within are identified. The charcoal fragments of each species identified are counted, weighted (grams) and bagged according to species.

Details of charcoal recording
The general age group of each taxa per sample is recorded, and the growth rates are classified as slow, medium, fast or mixed. It was not within the scope of this project to measure all the ring widths from the charcoal, however, some measurements are taken with a graticule in the microscope in order to make the scale of slow, medium and fast growth less subjective. Slow growth within the charcoal from this site is considered to be approximately 0.4mm per annum, medium, approximately 1mm per annum and fast, approximately 2.2mm per annum.

The ring curvature is also noted where applicable from each charcoal fragment. Weakly curved annual rings suggest the use of trunks or larger branches, while strongly curved annual rings indicate the burning of smaller branches or twigs **Fig. 1.** Tyloses within the vessels of species such as oak can denote the presence of heartwood. These are balloon-like outgrowths of adjacent parenchyma cells of xylem vessels (vascular tissue used to transport water and minerals). When the plant is subjected to stressful conditions, tyloses will develop and block the vascular tissue to prevent further damage to the plant.

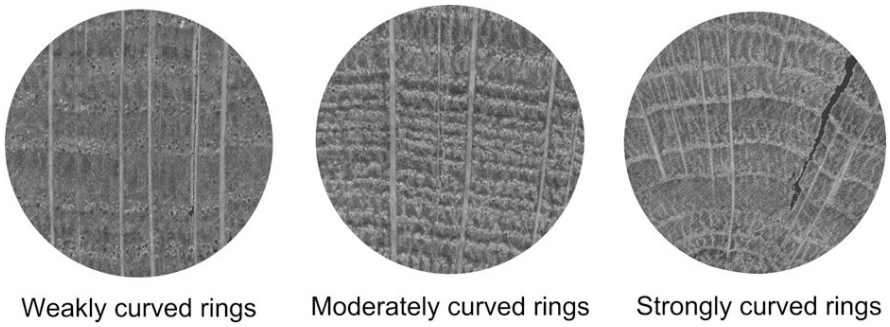

Fig. 1. Ring curvature (after Marguerie and Hunot 2007 1421, Fig. 3)

Results
The results of the charcoal identifications are summarized in **Table 1**

Five wood species totaling 60 identifications were recorded from the samples associated with Cranavonane 3. *Corylus avellana* (hazel) was the dominant wood

species recorded followed by *Alnus glutinous* (alder), *Salix* sp. (willow), *Fraxinus excelsior* (ash) and *Quercus* sp. (oak) **(Fig. 2)**.

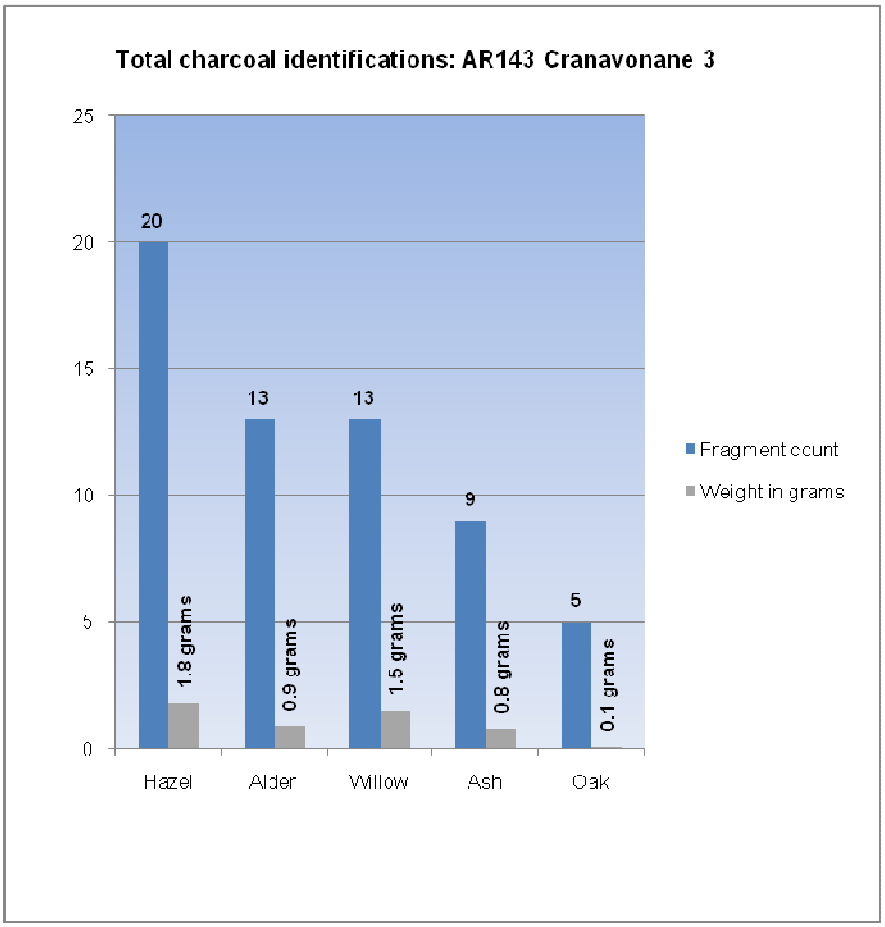

Fig. 2

The charcoal assemblage from C6/7/8/9 (fill of kiln C5) was dominated by hazel and willow. Alder, willow and ash was recorded from C10 (fill of pit C4), while oak was the only species recorded from C11 (fill of pit C4) (**Fig. 3)**.

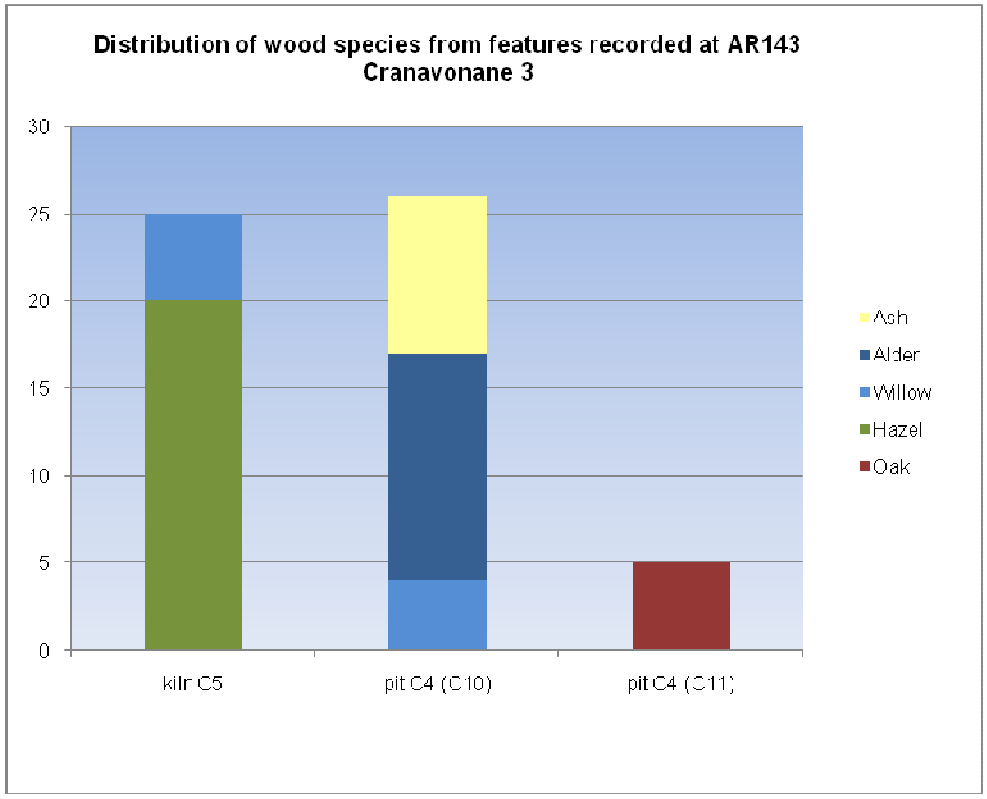

Fig. 3

Discussion

Background and origin of wood species

Corylus avellana L. (hazel)

Hazel woodlands replaced birch in the early post-glacial forests and remains on some shallow limestone soils to the present day (Pilcher & Hall, 2001). The species can tolerate most soil types, but not waterlogged conditions and forms a small deciduous tree or shrub. It commonly occurs in understorey of oak and/or ash woodlands, where it may grow to a height of 10m or more. In open areas or woodland glades hazel grows as a shrub. Hazel is a common species recorded from Irish archaeological sites and its widespread presence is highlighted in pollen diagrams from the Neolithic to the medieval period (Caseldine, 1996). It produces good firewood and is a suitable wood for kindling. The wood is soft enough to be split yet flexible and strong enough to be used in rope making and basketry. It has also proved a useful resource in the construction of hurdles, wattling, palisades and trackways from prehistoric times (Pilcher & Hall, 2001).

Alnus glutinous L. Gärtner (alder or black alder)

Alder is usually found growing close to running water, rivers or in damp woodland, in the latter often with oak (Orme and Coles, 1985; Rackham, 1995). In marshland alder grows as a shrub frequently mixed with willow and alder buckthorn to form alder carr (Cutler and Gale, 2000). It can also grow well in and on fen peat. Germination and early growth of alders requires a constant supply of water, however once the tree reaches maturity its root system makes the tree less dependent on high water levels (Stuijts, 2005). Alders commonly produce root nodules which contain nitrogen-fixing bacteria, known as *Schinzia alni* which enables alder to enrich soils through its fallen leaves hence allowing the tree to survive in poorer soil conditions (Milner cited in

Culter and Gale, 2000; van der Meiden cited in Stuijts, 2005). In suitable conditions alder growth is fast, usually reaching a height of 25m with a maximum girth of 1m and can grow to an age of sixty to one hundred years (Strotelder cited in Stuijts, 2005). While alder makes for poor fuel, it produces good quality charcoal (Edlin, 1951). Once in a waterlogged state, alder is very durable and is often used in the construction of underwater bridge piles, houses and scaffolding (Culter and Gale, 2000).

Salix spp. (willows).
There are a number of different species of willow which cannot be differentiated through wood anatomy. They grow rapidly, and can be easily propagated from cuttings. General comments only about the genus can be made, as there are different varieties of it. They are not naturally a woodland species, although shrubby growth may occur under light woodland cover. All willows appear to favour wet conditions, and it may be a pioneer species on wet soils. The use of willow depends on the species concerned, for some grow as shrubs and others as trees, and a species may be particularly suited to some purpose. In general, the flexibility of willow shoots has led to coppicing or pollarding to produce the raw materials for baskets, frames, hurdling etc. (Orme & Coles, 1985). The main Irish native willows are grey willow (*Salix cinera*), goat willow (*Salix caprea*) and eared willow (*Salix aurita*).

Fraxinus excelsior (ash)
Ash thrives well on nutrient-rich soils but is also a common woodland species and grows in mixed woodland with oak on damp, slightly acidic soils (Gale & Culter, 2000). Pollen analysis indicates that ash became more common in the pollen record from the Neolithic period onwards (Mitchell, 1953/4). This could be as a result of more clearance due to agricultural practices at the time, where ash was able to germinate and grow more vigorously as secondary woodland and in marginal areas and hedges (Kelly, 1976). Ash is also abundant in native hedgerows and was quite common in the later historic period.

Quercus sp. (oak)
Oak is a tall deciduous woodland tree, often growing in association with hazel and ash. Most species prefer damp, non-calcareous soils on lowland or montane sites. Of the 27 European species, pedunculate oak (*Quercus robur)* and sessile oak (*Quercus petraea)* are native to Ireland. Pedunculate oak is common on heavy clay lowland soils whereas sessile oak thrives on the lighter loams characteristic of higher ground (Culter & Gale, 2000). The wood is easy to cleave both radially and tangentially and has provided one of the most important building materials since the prehistoric period (Gale & Culter, 2000). The heartwood timber is renowned for its durability but the paler sapwood is susceptible to beetle and fungal attack. The strength of the timber depends on the species and is influenced by climatic and edaphic factors (Edlin, 1951). 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 & Gale, 2000).

Distribution of charcoal from Cranavonane 3
The number of identifiable charcoal fragments recovered from Cranavonane 3 were localised to two features; kiln C5 and pit C4. The composition of predominantly hazel and lesser willow from kiln C5 represents the woods selected for fuel within this feature. Both species were also identified from other kiln deposits, such as at Flemingston, Co. Dublin (Lyons, 2008) and Site AR31 Blackcastle and Borris, Co. Tipperary (Lyons, 2009a) to name but a few. Hazel was also the only species recorded from a kiln excavated at Gneevebeg, Co. Westmeath (O'Donnell, 2007, 51)

and from AR152 Templemartin 1 (Lyons, 2009b), another site from the N9/N10 Kilcullen to Waterford Scheme. This hazel and willow charcoal may also represent the charred remains of a drying platform or structure, which had burnt down within the kiln. Both species are pliable woods and the young shoots were used in wattling or in constructing light structures (Gale & Culter, 2000). Based on just one sample however, it is difficult to fully establish whether this material was part of a burnt structure, fuel debris or indeed a mix of both.

The composition of wood from pit C4 differed to that recorded from kiln C5. Since no obvious *in situ* burning was recorded from C4, it is likely that this pit functioned as a waste pit or dumping ground, as suggested (O'Carroll & O'Mahoney, 2009) for nearby firing events. The presence of alder, ash and willow from C10 may represent a different dumping episode that the charcoal recorded from C11, where oak was identified. Based on the charcoal identifications alone it is not possible to ascertain if C4 and C5 were contemporary or related to the same activity.

Summary

The charcoal fragments from C6/7/8/9 (fill of kiln C5), C10 (fill of pit C4) from C11 (fill of pit C4) from Cranavonane 3 were chosen for charcoal identification and analysis.

Kiln C5 contained hazel and willow, which represents fuel, burnt within this feature and may also represent the remains of a light structure or platform which had burnt down within the kiln. Pit C4 is likely to have functioned as a refuse pit of dumping ground for nearby firing activities and the wood composition recorded may denote two phases of dumping (C10) and (C11).

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Table 1 Charcoal identification details from Cranavonane (E3731)

Context number	Sample number	Flot volume (grams)	Context description	Wood Species Identifications	No. of fragments	Charcoal weights (grams)	Size of fragments (mm)	No. of growth rings	Growth ring curvature	Comments
6/7/8/9	001	3.5grams	Fill of kiln C5	Corylus avellana (hazel)	20	1.8 grams	4mm - 11mm	4 - 6 rings	strong	
				Salix sp. (willow)	9	1.1 grams	3mm - 9mm	2 - 4 rings		
010	002	1.3 grams	Fill of pit C4	Alnus glutinous (alder)	13	0.9 grams	4mm - 9mm	3 - 6 rings		
				Fraxinus excelsior (ash)	9	0.8 grams	5mm - 8mm	3 - 6 rings		
				Salix sp. (willow)	4	0.4 grams	5mm	4 - 5 rings		
011	3	0.1 grams	Fill of pit C4	Quercus sp. (oak)	5	0.1 grams	3mm	2 - 4 rings	strong	Small roundwoods

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Appendix 2.2 Plant Remains Analysis Report – Penny Johnston

Client – Irish Archaeological Consultancy Ltd
Site Name- Cranavonane 3
Excavation number –E3731 AR143
County – Carlow
Author- Penny Johnston

Date –25/9/09

1 Introduction

This report details the analysis of plant remains recovered from the excavation at Cranavonane 3, E3731 in advance of the construction of the N9/N10 Knocktopher to Powerstown Road (Phase 4).

2 Methodology

The samples for this phase were processed by the client, who also carried out a preliminary sorting of the samples. This pre-selection of the plant remains may bias the final plant records from these sites, as it is possible that many small items, such as weed seeds and chaff, were not picked out. As a result, only limited interpretation of the plant remains from this site is possible.

The selected material was sent to Eachtra Archaeological Projects where it was examined under a low-powered binocular microscope (X6–X45). Suitable plant material was identified and the results of analysis are presented at the end of this report. Scientific names are mainly confined to the identification table in order to facilitate easy reading of the text. Nomenclature and taxonomic orders generally follows Stace (1997).

3 Results

The site at Cranavonane 3 comprised an oval shaped kiln and a pit. The radiocarbon dates from this site suggest activity that dated to the Iron Age.

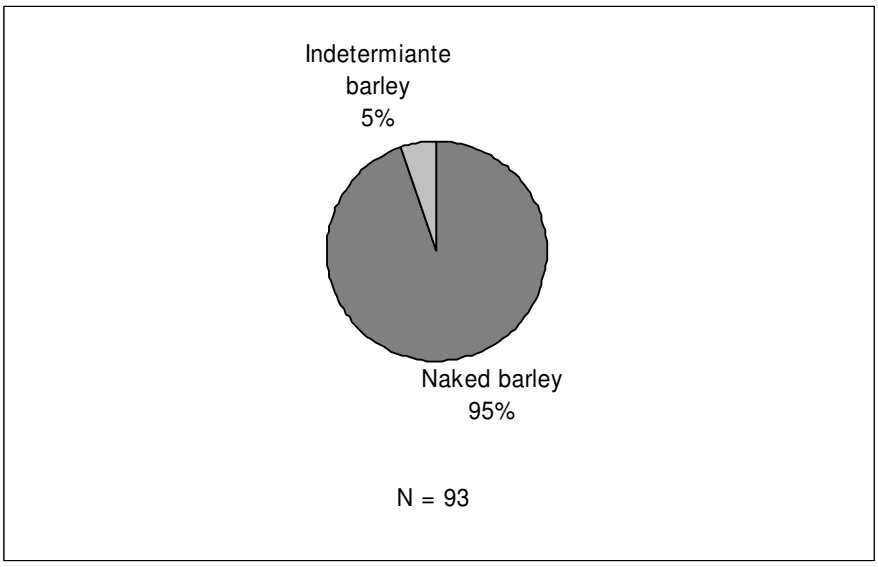
A single sample S.1 taken from four separate contexts: C.6, C.7, C.8 and C.9) was taken from this site. A large quantity of cereal grains were recovered (Table 5) and the majority of these, more than 50%, were not identifiable to species or genus (labelled as 'indeterminate cereal grains'). Of the identifiable grains, all were identified as barley and most of these (95%) were naked barley (Figure 3).

Naked barley is easier to process than the hulled variety of barley, since there is less chaff to remove from the grain before consumption. Hulled barley is often seen as more common than naked barley in Ireland (e.g. Johnston 2007b, 15) but the growing body of archaeobotanical data from Ireland has demonstrated that naked barley is also very common (see the short discussion in McClatchie 2007, 65). A brief survey of archaeobotanical material from Irish corn drying kilns found that barley was not usually predominant in kiln samples, being significant in only five examples (Monk and Kelleher 2005, 88). However, this survey is incomplete and more recently studied assemblages from kilns do sometimes include large quantities of barley grains. Examples include Site D at Killeen Castle, Co. Meath (Dillon and Johnston 2009,102) and at Ratoath, Co. Meath (Lyons 2005).

Table 5: Identified plant remains from Cranavonane 3

Context	**6,7,8,9**
Sample	**1**
Naked Barley grains (*Hordeum vulgare* L.) var. nudum	88
Barley grains of indeterminate species (*Hordeum* species)	5
Indeterminate cereal grains	97

Figure 3: Percentage composition of identifiable cereals from Cranavonane 3



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Appendix 2.3 Burnt Bone Report – Aoife McCarthy

Osteoarchaeological Report of Burnt Bone from
E3731: Cranavonane AR143
Co. Carlow
N9/N10 Kilcullen to Waterford Scheme
Phase 4b: Knocktopher to Powerstown
Author: Aoife McCarthy MA BA
Date: November 2009

1. Introduction

1.1 Introduction

This report details the osteological analysis of faunal remains recovered during excavations at Site E3731 AR143 Cranavonane in the townland of Cranavonane, Co. Carlow as part of the archaeological mitigation programme of the N9/N10 Kilcullen to Waterford Road Scheme. Aoife McCarthy MA (Osteoarchaeology University of Southampton 2006) undertook the analysis on behalf of Irish Archaeological Consultancy Ltd in November 2009. At the time of writing this report, background archaeological information was obtained from a draft interim excavation report (O'Carroll, E. 2009) and from consulting the original site register documents.

1.2 General Osteological Information

The osteological analysis of faunal remains was undertaken to provide an overview of the osteoarchaeological aspect of the site and determine if the material could provide further interpretation of site activity.

A total of 9 fragments from 7 possible skeletal elements and weighing 2.46g were recorded within the assemblage. The degree of preservation of the burnt bone material was poor with visible fragmentation and exposed trabecular or spongy bone.

The burnt bone remains recovered at Site 143 Cranavonane 3 originated from a single archaeological context C10 the loosely compacted dark brown silty fill of pit feature C4. A sample of ash charcoal from pit fill C10 was sent for radiocarbon dating and returned a date of Cal. 2 sigma BC 341-54 placing activity within the Iron Age period.

A total of 3 bone fragments (33.3%) of the faunal remains assemblage were identified to species. Due to the high degree of fragmentation and small size of the individual bone fragments it was not possible to identify 6 fragments (66.7%) these were classed as indeterminate vertebrate of small, medium or large size. Bone elements were identified where possible. The faunal remains assemblage recovered from Cranavonane 3 contained bones from a single species of pig.

2. Methodology

SPECIES IDENTIFICATION: Identification of the bones involved reference to Schmid (1972) and Hillson (1992) as well as comparison with the author's own reference material.

- NISP: Number of Identified Specimens Indicates the total number of fragments found.
- MNI: Minimum Number of Individuals. Indicates the minimum number of individuals from every species that were present in the material. Estimating MNI is calculated on the specimen of the most abundant skeletal element present; whilst taking age, sex, size and archaeological context into account.
- MNE: Minimum Number of Elements. Indicates the minimum number of anatomical units that are present and what side they are from. To avoid getting a higher MNE all loose epiphyses have to be paired with all un-fused diaphysis.

AGEING: Two main methods are used to determine the age of faunal remains; tooth eruption and degree of Epiphysial fusion (a less reliable method). Tooth eruption and

wear stages were recorded for the following teeth where possible; dP4 (deciduous fourth premolar), P4 (fourth premolar), M1 (first molar), M2 (second molar) and M3 (third molar) of cattle, sheep/goat and pig (Grant 1982). The analysis of tooth wear patterns refers to the alteration of the enamel surface and exposure of inner dentine through use. Due to the nature of material recovered from Cranavonane 3 ageing was not possible.

BIOMETRICAL DATA: Due to the degree of fragmentation of the burnt bone measurements were not taken.

SEX DETERMINATION: Sex determination of animal remains is possible by analysis of certain sexually dimorphic elements. For example goat horncores may be classified as male or female based on their morphology and cattle metacarpals can be defined as male or female through calculation of the slenderness index (McCormick 1992). Sexual determination of species was not possible due to the high degree of fragmentation of the animal bone material recovered from Cranavonane 3.

BUTCHERY/GNAWING/BURNING: Evidence for butchery was recorded under the categories of cut, chopped, chopped and cut. All specimens were analysed for evidence of rodent or carnivorous gnawing as well as evidence of burning. Burnt bones were recorded in accordance with colour changes resulting from differing heat levels e.g. calcined bones acquire a bluish-whitish hue through exposure to high temperatures.

PATHOLOGY: The discovery of any injury and/or pathology was recorded for all specimens, where present.

3. Results

Context 10 Sample 2
A total of 9 burnt bone fragments (2.46g) representing 7 possible skeletal elements were identified within C10 the loosely compacted dark brown silty clay fill of pit feature C4. Three (1.61g) of the 9 burnt bone fragments recovered from C10 were identified as pig/*sus* rib. The small size and poor preservation of the remaining six bone fragments (0.85g) meant it was not possible to identify species. Bone elements were identified where possible to skull.

Pig/*Sus*
Pig was the only recognisable animal species represented at Cranavonane 3, a total of 3 fragments which formed 33.3% of the complete burnt bone assemblage were recovered. The total weight of the recovered pig bone was 1.61g. The pig MNI was one and the skeletal element present within the assemblage was rib. None of the three re-constructible burnt pig/*sus* rib bone fragment recovered at Site AR143 displayed evidence of gnawing or butchery. Each of the three pig bone fragments displayed evidence of exposure to a high level of heat, resulting in the calcination of the bone, surface cracking and colour change to grey. Exposure of bone to heat is recognised by an alteration to bone texture and colour to white. Contact of bone with a source of heat diminishes moisture content and results in the combustion of the organic or collagen component. The remaining structure of bone after this process is complete is mineral. Such bone structure distortion reduces size and alters bone colour (Luff, R. & Pearce, J. 1994).

Indeterminate Vertebrate
Due to a degree of fragmentation, poor preservation and small size a series of 5 skull bone fragments of indeterminate vertebrate and 1 unidentifiable fragment were

recovered. All 6 indeterminate burnt bone fragments (66.7%) recovered from C10 displayed evidence of exposure to a high level of heat, resulting in the calcination of the bone. This was recognised by an alteration of the bone texture, surface cracking and colour to grey/white. As detailed contact of bone with heat diminishes its moisture content and results in the combustion of the organic or collagen component; the remaining structure of the bone after this process is mineral (Luff R. & Pearce J. 1994).

4. Summary

Nine burnt bone fragments recovered from a single archaeological context C10 the loosely compacted brown silty fill of pit feature C4 on Cranavonane 3 were submitted for examination. A total of 6 (66.7%) were not possible to identify to species due to small fragment size and poor preservation of the bone. The remaining 3 fragments (33.3%) were identified and divided into species type. The burnt bone assemblage contained bones from a single recognisable species of pig/*sus*.

Taphonomic alterations noted on the bone remains give us an insight into the processes that the assemblage went through before recovery. As shown in the bone database none of the 9 recovered bone fragments displayed evidence of gnawing or butchery. All 9 fragments showed evidence of exposure to heat. Each of the 9 bone fragments displayed surface cracking and colour change to grey/white, indicating contact with a high point of heat and an acceleration of the mineralisation process (Luff, R. & Pearce, J. 1994).

The burnt bone remains assemblage recovered at Cranavonane 3 originated from a single archaeological context C10 the loosely compacted dark brown silty fill of pit feature C4. A sample of ash charcoal from pit fill C10 was sent for radiocarbon dating and returned a date of Cal. 2 sigma 341-54 BC placing activity within the Iron Age period.

Bone Database:

Site Area	Spec	C	S	Taxa	Anat	Side	Prox	Dist	1	2	3	4	5	6	7	8	But	Bu	G	Q	Weight (g)	Comments
AR143 E3731	1	C10	2	Pig Size	Rib						1							G		3	1.61	Series of 3 (reconstructed) pig size prox. rib. Bone fragments surfaces are cracking and warped
AR143 E3731	2	C10	2	Unid	Skull													G		5	0.32	Fragments of calcined skull bone
AR143 E3731	3	C10	2	Unid	Unid													G W Bl		1	0.53	Fragment of trabecular bone, shows exposure to heat, bone has blue hues. Small-medium mammal

Key:

C= Context
S=Sample
Anat=Anatomical Element
Prox=Proximal
Dist=Distal
But=Butchery
Bu=Burnt
G=Gnaw
Q=Quantity of Pieces
G=Grey
W=White
Unid=Unidentifiable
Taxa=Taxon
B=Black

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GLOSSARY OF TERMS:

BOS: Latin term for Cow
SUS: Latin term for Pig
CERVUS: Latin term for Deer
EQUUS: Latin term for Horse
OVIS: Latin term for Sheep
CAPRINAE: Latin term for Sheep/Goat
CANIS: Latin term for Dog
LEPUS: Latin term for Hare
AVES: Latin term for Bird
TAPHONOMY: The study of the processes affecting an organism after death from the time of burial until collection.
TRABECULAR BONE: Osseous tissues that fill the interior cavity of bones and resemble a sponge or honeycomb.
DIAPHYSIS: Bone shaft
CORPUS COSTAE: Body of Rib Bone

Appendix 2.4 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 two-sigma (95.4% probability) level of confidence.

Calibration data set: intcal04.14c

Context	Sample No	Material	Species id/ Weight	Lab	Lab Code	Date Type	Calibrated date ranges	Measured radiocarbon age (BP)	13C/12C Ratio ‰
C6/7/8/9, Fills of a kiln	1	Charcoal	*Corylus avellana* / 0.07g	QUB	UBA 12251	AMS (Std)	52BC–AD16 (1 sigma), 104BC–AD50 (2 sigma)	2028 ± 24	-29.1
C10, Fill of a pit	2	Charcoal	*Fraxinus excelsior* / 0.1g	QUB	UBA 12252	AMS (Std)	196–111BC (1 sigma), 341–54BC (2 sigma)	2122 ± 24	-26.0

References for calibration datasets:
PJ Reimer, MGL Baillie, E Bard, A Bayliss, JW Beck, PG Blackwell, C Bronk Ramsey, CE Buck, GS Burr, RL Edwards, M Friedrich, PM Grootes, TP Guilderson, I Hajdas, TJ Heaton, AG Hogg, KA Hughen, KF Kaiser, B Kromer, FG McCormac, SW Manning, RW Reimer, DA Richards, JR Southon, S Talamo, CSM Turney, J van der Plicht, CE Weyhenmeyer (2009) Radiocarbon 51:1111-1150.

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 LIST OF RMP IN AREA

RMP No	Description
CW012-020	Ringfort
CW012-098	Ringditch
CW012-099	Enclosure
CW012-022001	Church
CW012-022002	Font
CW012-022003	Graveyard
CW012-067	Holy well
CW012-083	Enclosure
CW012-061	Earthwork
CW012-041	Enclosure
CW012-042	Mound
CW012-043	Ringbarrow
CW012-039	Earthwork
CW011-018	Enclosure
CW011-008	Metalworking site

See Figure 2 for location.

APPENDIX 4 LIST OF SITE NAMES

Site Name	Site Code	E Number	Director	NGR
Baysrath 2	AR055	E3627	Fintan Walsh	251593/137855
Baysrath 3	AR056	E3628	Fintan Walsh	251672/138000
Baysrath 4	AR057	E3629	Fintan Walsh	251515/138280
Danganbeg 1	AR058	E3606	Emma Devine	251462/138754
Danganbeg 2	AR059	E3607	Emma Devine	251397/138939
Danganbeg 3	AR060	E3671	Emma Devine	251430/139245
Danganbeg 4	AR061	E3676	Emma Devine	251401/139372
Knockadrina 1	AR062	E3677	Ed Lyne	251422/139420
Tinvaun 1	AR063	E3678	Ed Lyne	251482/139625
Tinvaun 2	AR064	E3680	James Kyle	251445/139736
Tinvaun 3	AR065	E3608	James Kyle	251501/139832
Tinvaun 4	AR066	E3609	James Kyle	251508/139917
Stonecarthy West 1	AR067	E3610	James Kyle	251538/140023
Knockadrina 1	AR068	E3611	James Kyle	251647/140237
Rathduff 1	AR069	E3612	Ed Lyne	251286/142167
Rathduff Upper 1	AR070	E3613	Ed Lyne	251280/142559
Kellsgrange 1	AR071	E3575	James Kyle	250911/143732
Kellsgrange 2	AR072	E3577	James Kyle	250967/143861
Kellsgrange 3	AR073	E3576	James Kyle	250948/144003
Ennisnag 1	AR074	E3614	Richard Jennings	251416/145690
Ennisnag 2	AR075	E3615	Richard Jennings	251638/146068
Danesfort 12	AR076	E3616	Richard Jennings	251669/146186
Danesfort 13	AR077	E3617	Richard Jennings	251765/146384
Danesfort 2	AR078	E3540	Richard Jennings	251953/146745
Danesfort 4	AR079	E3539	Richard Jennings	251880/147579
Danesfort 3	AR080A	E3542	Richard Jennings	252221/146845
Danesfort 1	AR080B	E3541	Richard Jennings	252267/146707
Croan 1	AR081	E3543	Emma Devine	252280/147332
Danesfort 5	AR082	E3456	Emma Devine	252567/147767
Danesfort 6	AR083	E3538	Emma Devine	252764/147995
Danesfort 7	AR084	E3537	Emma Devine	252878/148099
Danesfort 8	AR085	E3461	Richard Jennings	253020/148246
Danesfort 9	AR086	E3458	Richard Jennings	253089/148345
Danesfort 10	AR087	E3459	Richard Jennings	253229/148414
Danesfort 11	AR088	E3460	Richard Jennings	253245/148462
Rathclogh 1	AR089	E3726	Patricia Lynch	253365/145515
Rathclogh 2	AR090	E3727	Patricia Lynch	253650/148848
Kilree 1	AR091	E3728	Patricia Lynch	254088/149310
Kilree 2	AR092	E3729	Patricia Lynch	254320/149500
Kilree 3	AR093	E3643	Patricia Lynch	254449, 149639
Kilree 4	AR094	E3730	Patricia Lynch	255330/150084
Dunbell Big 2	AR095	E3853	Yvonne Whitty	256684/151066
Holdenstown 1	AR096	E3681	Yvonne Whitty	256737/151253
Holdenstown 2	AR097/98	E3630	Yvonne Whitty	256891/151781
Holdenstown 3	AR099	E3854	Yvonne Whitty	256990/152085
Holdenstown 4	AR100	E3682	Yvonne Whitty	256828/152048
Dunbell Big 1	AR101	E3855	Yvonne Whitty	257034/152315
Rathcash 1	AR102	E3859	Tim Coughlan	258178/154199
Rathcash 2	AR103	E3860	Tim Coughlan	258294/154293
Rathcash East 1	AR104	E3892	Tim Coughlan	259419/154546
Rathcash East 2	AR105	E3893	Tim Coughlan	259555/154566
Rathcash East 3	AR106	E3861	Tim Coughlan	259821/154653
Blanchvillespark 1	AR107	E3894	Richard Jennings	260535/155212
Blanchvillespark 2	AR108	E3895	Tim Coughlan	260637/155449
Blanchvillespark 3	AR109	E3913	Tim Coughlan	260785/155653

Site Name	Site Code	E Number	Director	NGR
Blanchvillespark 4	AR110	E3914	Tim Coughlan	261442/156269
Blanchvillespark / Ballyquirk 1	AR111	E3862	Ruth Elliott	261531/156323
Ballyquirk 1	AR112	E3863	Ruth Elliott	261531/156323
Ballyquirk 2	AR113	E3864	Ruth Elliott	261811/156508
Ballyquirk 3	AR114	E3865	Ruth Elliott	261875/156559
Ballinvally 1	AR115	E3836	Emma Devine	263258/157521
Garryduff 1	AR116	E3852	Emma Devine	263933/157991
Kilmacahill 1	AR117	E3915	Tim Coughlan	264267/158369
Kilmacahill 2	AR118	E3833	Tim Coughlan	264380/158453
Jordanstown 1	AR119	E3834	James Kyle	264546/158643
Jordanstown 2	AR120	E3851	James Kyle	264893/159038
Kellymount 6	AR121	E3758	Przemaslaw Wierbicki	265130,159277
Jordanstown 3	AR122	E3916	Przemaslaw Wierbicki	265103/159227
Kellymount 1	AR123	E3756	Przemaslaw Wierbicki	265250/159397
Kellymount 2	AR124	E3757	Przemaslaw Wierbicki	265164/159463
Kellymount 3	AR125	E3856	Przemaslaw Wierbicki	265338/159597
Kellymount 4	AR126	E3857	Przemaslaw Wierbicki	265412/159803
Kellymount 5	AR127	E3858	Przemaslaw Wierbicki	265530,159977
Shankill 2	AR128	E3738	Richard Jennings	265924/160651.
Shankill 3	AR129	E3737	Richard Jennings	266052/161141
Shankill 4	AR130	E3838	Richard Jennings	266286/161526
Shankill 5	AR131	E3850	Richard Jennings	266374/161730
Shankill 6	AR132	E3840	Richard Jennings	266403/161836
Moanmore 1	AR133	E3835	Richard Jennings	266476/162016
Moanmore 2	AR134	E3843	Sinead Phelan	266756/162866
Moanmore 3	AR135	E3837	Sinead Phelan	266856/163259
Bannagagole 1	AR136	E3844	Sinead Phelan	266942/163569
Moanduff 1	AR137	E3839	Robert Lynch	267261/164397
Coneykeare 1	AR138	E3683	Sinead Phelan	267836/166209
Coolnakisha 1	AR139	E3768	Ellen O'Carroll	268175/167274
Coolnakisha 2	AR140	E3767	Ellen O'Carroll	268306/167559
Cranavonane 1	AR141	E3842	Tim Coughlan	268554/167895
Cranavonane 2	AR142	E3732	Ellen O'Carroll	268830/168154
Cranavonane 3	AR143	E3731	Ellen O'Carroll	269123/168362
Tomard Lower 1	AR144	E3733	Ellen O'Carroll	269349/168496
Paulstown 1	AR145	E3642	Ruth Elliot	265889/158499
Paulstown 2	AR146	E3632	Ruth Elliot	265664/158651
Rathgarvan or Clifden 1	AR147	E3760	Przemaslaw Wierbicki	257026/154123
Maddockstown 1	AR148	E3759	Przemaslaw Wierbicki	256886/154199
Templemartin 3	AR149	E3845	Emma Devine	255095/155200
Templemartin 4	AR150	E3841	Emma Devine	254920/155427
Templemartin 5	AR151	E3846	Emma Devine	254706/155636
Templemartin 1	AR152	E3849	Emma Devine	254504/155826
Templemartin 2	AR153	E3847	Emma Devine	254173/156236
Leggetsrath East 1	AR154	E3734	Emma Devine	253793/156484
Moanduff 2	AR155	E3735	Sinead Phelan	267470/164887
Moanduff 3	AR156	E3736	Sinead Phelan	267515/164979
Ballyquirk 4	AR157	E3848	Richard Jennings	262596/157025
Shankill 1	AR158	E3766	Przemaslaw Wierbicki	265707/160269
Rathgarvan or Clifden 2	AR159	E3921	Tim Coughlan	257095/154119
Ballynolan 1	AR160	E3755	Sinead Phelan	267714/165597
Stonecarthy West 2	UA2	E3974	Tim Coughlan	251372/142037
Rathduff Bayley 1	UA4	E4011	Tim Coughlan	251005/143564