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

Ministerial Direction Scheme Reference No.	A032
Registration No.	E3916
Site Name	AR122, Jordanstown 3
Townland	Jordanstown
County	Kilkenny
Excavation Director	Przemyslaw Wierzbicki
NGR	265103 159227
Chainage	64500

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	E3916
Excavation Director	Przemyslaw Wierzbicki
Senior Archaeologist	Tim Coughlan
Consultant	Irish Archaeological Consultancy Ltd, 120b Greenpark Road, Bray, Co. Wicklow
Client	Kilkenny County Council
Site Name	AR122, Jordanstown 3
Site Type	Burnt mound
Townland(s)	Jordanstown
Parish	Paulstown
County	Kilkenny
NGR (easting)	265103
NGR (northing)	159227
Chainage	64500
Height OD (m)	69.130
RMP No.	N/A
Excavation Dates	10–18 December 2007
Project Duration	20 March 2007–18 April 2008
Report Type	Final
Report Date	January 2012
Report By	Przemyslaw Wierzbicki and Tim Coughlan
Report Reference	Wierzbicki, P. and Coughlan, T. 2012 E3916 Jordanstown 3 Final Report. Unpublished Final Report. National Monuments Service. Department of the Environment, Heritage and Local Government, Dublin.

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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.

CONSULTING ENGINEERS – N9/N10 KILKENNY CONSULT

James Eogan (NRA Senior Archaeologist), Ed Danaher (NRA Archaeologist) and Bernice Kelly (NRA Assistant Archaeologist)

Project Liaison Officer, Kilkenny Co. Council – Joe Gannon and Lisa Mulcahy

NATIONAL MONUMENTS, DOEHLG

Archaeologist – Martin Reid

IRISH ANTIQUITIES DIVISION, NATIONAL MUSEUM OF IRELAND

Assistant Keeper – Nessa O'Connor

ABSTRACT

Irish Archaeological Consultancy Ltd (IAC), funded by the National Roads Authority (NRA) through Kilkenny County Council, undertook an excavation at the site of AR122, Jordanstown 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 Przemyslaw Wierzbicki under Ministerial Direction A032 and Excavation Registration Number E3916 issued by the DOEHLG in consultation with the National Museum of Ireland for IAC. The fieldwork took place between the 10 and 18 December 2008.

The excavation identified the remains of an early Bronze Age burnt mound. A small sub-oval trough was recorded that was probably originally lined, as evidenced from a series of small stakeholes around the perimeter of the base, although no lining survived *in situ*. Adjacent to the trough was a small pit and two considerably larger pit features which were connected by a shallow channel. It is thought that the larger pits may have had a function related to water management or storage. A very small burnt spread was identified and it is likely that the remainder of the burnt deposit was probably removed or disturbed in antiquity.

A total of 2 samples were sent for AMS radiocarbon dating. The results of the analysis dated ash charcoal from the fill C11 of a trough C8. The 2 sigma calibrated date was 2457–2202BC (UBA 13119). The results of the analysis dated ash charcoal from the fill C27 of a pit C9. The 2 sigma calibrated date was 2401–2148BC (UBA 13120).

There were no prior prehistoric monuments in the immediate area and as such the identification of the site could be viewed as unexpected. However the site is in a marginal and wet landscape, an area where bunt mound sites are typically found. The presence of other burnt mounds in the immediate area confirms that it is an area that was attractive for this type of activity throughout the Bronze Age. The site is important locally as it provides evidence for previously unknown occupation of this landscape in the early Bronze Age.

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1 INTRODUCTION

1.1 General

This report presents the results of the archaeological excavation of Jordanstown 3, AR122 (Figure 1), in the townland of Jordanstown undertaken by Przemyslaw Wierzbicki 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 478m^2 and was first identified during testing carried out between 27 March and 6 April 2007 by Richard Jennings (E3364) for IAC Ltd. on behalf of the National Roads Authority. Jordanstown 3 was excavated between the 10 and 18 December 2007 with a team of one director and six 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.

All artefacts uncovered on site were dealt with in accordance with the guidelines as issued by the NMI and where warranted in consultation with the relevant specialists. 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 excavated area was situated on slightly undulating pastureland. There were no rivers or streams in the vicinity but a small natural pool was located *c.* 100m north-west of the site (Plate 1). The site had an easterly aspect. This raise provides natural drainage in the immediate vicinity. To the north of the natural pool, the remains of what appeared to be a tree-lined avenue extending *c.* 400m north-westwards and may once have run as far as Kellymount House (KK016-009002) *c.* 1.1km away. A souterrain (KK016-009001) is also recorded in the grounds of this house. Low-lying hills run from the north to the west, there are prominent mountains on the horizon to the east and the terrain rolls gently to the south. Kellymount 6 is divided into four areas, which are located between *c.* 40 and 70m to the west, north and NNW of this site.

2.1 PHASE 1 Natural Drift Geology

2.1.1 Subsoil

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C2	N/A	N/A	N/A	N/A	Brownish-Yellow, Sand-Clay	Subsoil

The natural geology on the site consisted of brownish-yellow, sandy clay with moderate gravel content. It was fairly homogenous across the site. All subsequent archaeological features and deposits cut and sealed the natural subsoil.

2.1.2 Natural Pool C35

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C35	N/A	*c.*15	*c.*10	0.5	Oval, Natural Depression	Remains of Natural Pool
C33	C35	*c.*15	*c.*10	0.4	Grey sandy-silt, bottom fill	Natural sedimentation
C34	C35	*c.*15	*c.*10	0.15	Greyish-yellow, clayey-silt, top fill	Natural sedimentation

Finds: None

A shallow depression in the topsoil, C35, was visible before the excavations commenced (Plate 1). After the topsoil was removed the depression turned out to be much larger and deeper than previously anticipated. It contained two fills, C33 and C34, which were probably washed into the pool from other areas of the site. The occasional charcoal inclusions most likely originated from the pits located to the west. The pool was similar to that identified at Kellymount 6 located only *c.* 250m away. This was separate to the larger pool of water located *c.* 100m north-west of site.

2.2 PHASE 2 Early Bronze Age Burnt Mound Activity

2.2.1 Trough C8 and Associated Features

2.2.1.1 Trough C8

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C4	C8	0.68	0.55	0.25	Brown to dark brown, sandy-clay	Top fill of pit
C8	N/A	0.82	0.74	0.47	Oval pit, with interior stakeholes	Oval pit
C10	C8	0.6	0.45	0.08	Greyish to yellowish brown, sandy-silt	Middle fill of pit
C11	C8	0.75	0.65	0.31	Dark-grey, sandy-silt	Bottom fill of pit
C12	C8	0.15	0.8	0.15	Grey, sandy-silt	Upper fill of pit

2.2.1.2 Stakeholes within Trough C8

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C13	N/A	0.08	0.06	0.13	Cut of stakehole within pit (C8)	Stakehole
C14	C13	0.08	0.06	0.13	Light-grey, clayey-silt	Fill of stakehole
C15	N/A	0.09	0.06	0.12	Cut of stakehole within pit (C8)	Stakehole

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C16	C15	0.09	0.06	0.12	Light-mid grey, clayey-silt	Fill of stakehole
C17	N/A	0.14	0.07	0.14	Sub-rectangular stakehole, in pit (C8)	Stakehole
C18	C17	0.14	0.07	0.14	Light to mid-grey, clayey-silt	Fill of Stakehole
C19	N/A	0.16	0.08	0.12	Sub-rectangular stakehole, in pit (C8)	Stakehole
C20	C19	0.16	0.08	0.12	Light to mid-grey, clayey-silt	Fill of Stakehole
C21	N/A	0.12	0.08	0.09	Sub-rectangular stakehole, in pit (C8)	Stakehole
C22	C21	0.12	0.08	0.09	Light to mid-grey, clayey-silt	Fill of Stakehole
C23	N/A	0.15	0.09	0.18	Sub-rectangular stakehole, in pit (C8)	Stakehole
C24	C23/37	0.31	0.09	0.18	Light to mid-grey, clayey-silt	Fill of Stakehole
C37	N/A	0.16	0.09	0.18	Sub-rectangular stakehole, in pit (C8)	Stakehole

2.2.1.3 Stakehole external to Trough C8

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C31	N/A	0.11	0.07	0.11	Cut of stakehole, beside pit (C8)	Stakehole
C32	C31	0.11	0.07	0.11	Dark-grey, sandy-silt	Fill of Stakehole

Finds:

Context	Find No	Material	Period	Description
4	E3916:004:1	Flint	EBA	Micro disc scraper
12	E3916:012:1	Flint	EBA	Flint debitage

Trough C8 consisted of an oval pit that had seven stakeholes, C13, C15, C19, C17, C21, C23 and C37, driven into its base (Figures 4–5; Plate 4). The position of these stakeholes primarily around the perimeter of the base suggests that they supported a timber lining, although no lining material was identified in the course of excavation. The lower fills of the trough C11 and C12, consisted of typical burnt mound material (heat-shattered stones in a charcoal-rich matrix) and also contained fragments of burnt bone and flecks of possibly burnt lithic material. This bone and lithic material may represent the remains of activity which occurred in or around the trough. A layer, C10, of redeposited subsoil mixed with ash overlay these two fills and suggested that the trough had been abandoned by the time of the deposit. Upper fill C4, which also contained occasional fragments of burnt bone, was possibly associated with deliberate backfilling and represents disturbed mound material

A stakehole, C31, was located beside pit C8 and was probably associated with it (Figure 4; Plate 5).

Two lithics were retrieved from C4 and C12. The lithic retrieved from C4 is a retouched flint artefact and has been identified as a micro disc scraper. It is typologically diagnostic and dates to the early Bronze Age period. The lithic retrieved from C12 has been identified as a piece of flint debitage and also dates to the early Bronze Age period (Sternke, Appendix 2.1).

Charcoal analysis of fill C11 (fill of pit C8) indicated a predominance of oak (*Quercus* sp.), ash (*Fraxinus excelsior*), willow (*Salix* sp.) and blackthorn (*Prunus spinosa*) (Lyons, Appendix 2.2). While this material represents the remains of firing events associated with *fulacht fiadh* activity at the site, the exact source of the material is unknown. It is likely to be re-deposited or dumped charred debris from one or more episodes of burning (*ibid.*).

A total of 10 burnt animal bone fragments (1.14g) representing 10 possible skeletal elements were identified within C10. Small fragment size combined with a poor degree of preservation meant it was not possible to identify species (McCarthy, Appendix 2.3).

A single calcined long bone diaphysis fragment (0.45g) of a small size mammal was recovered from C11, the bottom fill of pit C8. Two calcined rib corpus fragments (0.31g) of a small size mammal were retrieved within C12 the fill of pit C8. The small fragment size combined with a poor degree of preservation meant it was not possible to identify species of the bone fragments (*Ibid.*).

A total of 12 burnt bone fragments (1.07g) representing 11 possible skeletal elements were retrieved from C4 the upper fill of pit C8). The small fragment size combined with a poor degree of preservation meant it was not possible to identify species of 10 fragments. Two calcined phalanx fragments were identified to pig (*Sus*) (*Ibid.*).

Stone retrieved from C11 was analysed and was found to be very course grained, quartz rich, red/yellow sandstone. Course grained sandstone is typical of *fulacht fiadh* material. The sample is clearly a shattered cobble, indicating a secondary source, such as in the glacial tills / river cobbles. It is therefore possible that these rocks were sourced locally (Mandal, Appendix 2.4).

A small fragment (0.05g) of ash was chosen for AMS dating from C11 and returned a result of 3838±25 (UBA 13119). The 2 Sigma calibrated result for this was 2457–2202BC (QUB, Appendix 2.5) dating this feature to the early Bronze Age.

2.2.2 Large Pits C9 and C30

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C6	C9	2.4	1.44	0.13	Dark Brownish-Grey, Silty-Sand	Top fill of pit
C9	N/A	2.7	2.06	0.48	Large oval pit, NW-SE orientated	Oval Pit
C25	C9	0.44	0.3	0.1	Greyish-yellow, sandy-clay	Pockets of redeposited subsoil
C26	C9	1.8	1.3	0.23	Grey sandy-silt	Middle fill of pit
C27	C9	2.7	1.93	0.45	Dark-grey sandy-silt	Bottom fill of pit
C28	C30	2	1.8	0.14	Greyish-brown sandy-silt	Top fill of pit
C29	C30	3.18	2.2	0.2	Mid to dark grey, sandy-silt	Bottom fill of pit
C30	N/A	3.18	2.2	0.27	Shallow sub-oval pit	Sub-oval pit
C36	N/A	0.90	0.50	0.07	Shallow cut between larger pits	Connecting channel

Finds: None

An oval pit C9 (Figures 4–5; Plates 2–3) and sub-oval possible pit C30 were located immediately to the east of the pool C35, and to the west of the trough C8. Both pits were joined by a very shallow and short channel C36. Pit C9 was deeper than its counterpart and was more neatly constructed which suggested that it had a more significant function than that of pit C30 which appeared to be subsidiary. The pits appeared too large to have functioned efficiently as troughs but they may represent secondary troughs to the timber lined trough C8. The may also have been used for storage, perhaps of water. The channel was filled by the upper fills of the pits, C9 and C30, and a precise division between the two was not perceptible.

Both pits were filled with similar burnt mound material, C26, C27 filled C9 and C29 filled C30, which also spread beyond the pits. Two pockets of redeposited natural subsoil, C25, were found directly above the burnt mound fills of pit C9. This deposition was followed by a final abandonment of the two pits in the form of upper fills C6 and C28.

Charcoal analysis of fill C27 (fill of pit C9) indicated a predominance of oak (*Quercus* sp.), hazel (*Corylus avellana*), ash (*Fraxinus excelsior*), willow ((*Salix* sp.) and blackthorn (*Prunus spinosa)*. While this material represents the remains of firing

events associated with *fulacht fiadh* activity at the site, the exact source of the material is unknown. It is likely to be re-deposited or dumped charred debris from one or more episodes of burning (Lyons, Appendix 2.2).

Stone retrieved from C27 was analysed and was found to be very course grained, quartz rich, red/yellow sandstone. Course grained sandstone is typical of *fulacht fiadh* material. The sample is clearly a shattered cobble, indicating a secondary source, such as in the glacial tills / river cobbles. It is therefore possible that these rocks were sourced locally (Mandal, Appendix 2.4).

A small fragment (0.5g) of ash was chosen for AMS dating from C27 and returned a result of 3820±25 (UBA 13120). The 2 Sigma calibrated result for this was 2401–2148BC (QUB, Appendix 2.5) dating this feature to the early Bronze Age.

2.2.3 Pit C7

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C3	C7	0.59	0.5	0.19	Grey, clayey-silt, burnt stones, charcoal	Fill of pit
C7	N/A	0.59	0.5	0.19	Cut of small oval pit	Oval pit

Finds: None

A small pit, C7, was situated to the south of the other features (Figures 4–5; Plate 5). The pit contained burnt stones in its fill, C3, which indicated its association with the burnt mound activity on site, but its precise function is unknown.

2.2.4 Burnt Spread C5

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C5	N/A	3.8	0.9	0.15	Dark grey sandy-silt, charcoal, burnt stones	Burnt-mound spread

Finds: None

A spread of burnt mound material, C5, survived in a short, narrow, kidney-shaped natural depression in the ground (Figure 4). It represented waste material discarded from pits C7, C8, C9, and C30. It may have originally been more substantial but was ploughed out by subsequent agricultural activity.

2.3 PHASE 3 Topsoil

Context	Fill of	L(m)	W(m)	D(m)	Basic Description	Interpretation
C1	N/A	N/A	N/A	-	Brown to dark-brown, sandy-silt	Topsoil

Topsoil sealed the entire site and consisted of a brown, sandy silt.

3 SYNTHESIS

The synthesis presents the combined results of all of the archaeological analysis carried out at Jordanstown 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. Jordanstown 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 excavated area was situated on slightly undulating pastureland. There were no rivers or streams in the vicinity but a small natural pool was located *c.* 100m north-west of the site (Plate 1). The site had an easterly aspect. This raise provides natural drainage in the immediate vicinity. To the north of the natural pool, the remains of what appears to be a tree-lined avenue extend *c.* 400m north-westwards and may once have run as far as Kellymount House (KK016-009002) *c.* 1.1km away. A souterrain (KK016-009001) is also recorded in the grounds of this house. Low-lying hills run from the north to the west, there are prominent mountains on the horizon to the east and the terrain rolls gently to the south. Kellymount 6 is divided into four areas, which are located between *c.* 40 and 70m to the west, north and NNW of this site.

3.2 The Archaeological Landscape

As part of the general research relating to sites along the scheme and the specific research relating to Jordanstown 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 Jordanstown 3 has been identified as being Bronze Age in date.

3.2.1 The General Bronze Age Landscape of the Scheme – compiled by Michelle Brick

The archaeological record implies that the Irish Bronze Age (2500–800BC) population dramatically increased from that of the Neolithic and the evidence for permanent settlements with considerable longevity becomes much more substantial. In addition, a wide range of ritual and funerary activity associated with this settlement is apparent. The overall environmental record for Ireland suggests that there was a general climatic deterioration in the Bronze Age, bringing wetter, colder conditions; during this period there was also accelerated forest clearance with more intensive habitation in the drier lowlands. As a result of extensive development-led projects across the country, understanding of settlement and burial patterns from the early Bronze Age has greatly developed. The distribution of the prehistoric evidence shows that the Rivers Nore and Barrow provided a focus for settlement. In the central part of the current portion of the N9/N10 Phase 4 the fertile Kilkenny lowlands have produced some Bronze Age archaeology, particularly in Danesfort and Ennisnag townlands. In the northern part of the scheme intense settlement is indicated by both burnt mounds and barrows existing on the uplands of the Castlecomer Plateau and the flanking valleys of the Nore and Suir. Hillforts appear to be positioned to overlook the settlement activity, as well as the route of the Nore, the lower saddle to the north of the Slieveardagh Hills, and to the south of the spur surmounted by Clonmantagh. A considerable number of ringditches, cremation and inhumation burials (single and grouped), burnt mound sites, structures and domestic settlement evidence, have been recorded as part of the Bronze Age on the N9/N10 Phase 4.

In the southern landscape the exposure of domestic Bronze Age settlement was less forthcoming than that of the northern landscape. There was little direct evidence for structures in the southern and central landscapes with the exception of a cluster of structures in the Danesfort area. Instead most of the settlement activity that fell within

the roadtake was noted in the northern landscape, further to the north of Kilkenny and in Carlow. Ritual and burial is a dominant feature of the Bronze Age in Kilkenny and Carlow as indicated by the presence of flat cemeteries, burial cairns, ringditches, mounds, barrows and hillforts throughout these counties. Freestone Hill situated in Coolgrange, Co. Kilkenny, in the centre of the present landscape is just one example of these sites. Along the lower part of the Nore Valley, and concentrated in the Foulksrath and Jenkinstown areas, the landscape is dominated by barrows (in this case more specifically ringditches). The contrasting locations of these site types most probably relate to differential landscape exploitation by the same communities with some activities, possibly associated with the seasonal use of upland pasture, confined to higher terrain and settlement and funerary activity taking place in the more sheltered lowlands.

The significant number of burnt mound sites discovered due to the N9/N10 excavations, combined with the previously known examples in the RMP reinforces the concept that Bronze Age activity in Kilkenny and Carlow was considerable. A total of 36 sites with evidence for burnt mound activity were uncovered during the N9/N10 excavations, with an additional example discovered, and preserved outside, the roadtake. The burnt mounds are focussed in the upland area, especially along the river and stream valleys, such as at Clashduff, Coan West and Muckalee on the Dinin and Douglas Rivers, and in the upland hinterland of Freestone Hill.

The distribution of the prehistoric evidence shows that the Rivers Nore and Barrow provided a focus for Bronze Age settlement. The patterning of human activity in the region indicates that these were also the principal route-ways in prehistory; both were navigable by small craft but they, and the major tributaries of the Nore– the Dinin and King's Rivers – were also conspicuous landscape features that facilitated accurate navigation through this landscape. The Barrow and Nore also provided access to wider networks beyond the region.

The Northern Landscape: Domestic Settlement

The domestic settlement evidence from the landscape along the northern sections of Kilkenny and the border with Carlow can be characterised by multi-period sites, such as at Moanduff 2–3, and by clusters of activity represented by multiple burnt mound sites and several, possibly associated, structures. This part of the Barrow is overlooked by the hillforts at Freestone Hill (KK020-018002) (Coolgrange), Ballinkillin (CW019-027) and Killoughternane (CW019-065). However, the distinct clustering of the Paulstown area sites suggests the existence of a community separate to that in the immediate vicinity of Freestone Hill although it is probable that the hillforts reflect a wider landscape control system involving co-operation or alliance between a number of communities in the Kilkenny region. In addition to the indirect evidence in the form of burnt mounds and cultural deposits in pits, several structures, of typical Bronze Age morphology, were recovered. At Garryduff 1 an external ring of 37 postholes and stakeholes was positioned in a shallow, curving slot-trench and enclosed an area 11m in diameter with an inner ring of 10 larger postholes (7m diameter). This structure was located on the edge of a break of slope, which led down to an adjacent river. Other features on site may represent a possible grain stand and pits for food storage/rubbish. In the south-western corner of the site a curving arc (12m long) of 18 postholes and stakeholes was identified which may continue beyond the site. Six kilometres to the north of Garryduff 1 was an oval-shaped structure at Shankill 4. This was most likely a hut (4m x 3m) and consisted of postholes, stakeholes, an internal hearth, and outlying pits. An arc of stakeholes measuring 3m by 2.5m on its north side might have formed an entrance porch. Sherds from at least one domestic cordoned urn came from the site. A roundhouse at Moanmore 2

consisted of 14 postholes, a central hearth, and up to 50 associated stakeholes and postholes.

As well as two rectangular Neolithic structures at Moanduff 2–3 there were four, or possibly five, separate areas of Bronze Age activity identified. As the features representing this activity were heavily truncated it is impossible to identify their exact function however some may represent Bronze Age structures. A middle-late Bronze Age enclosure (180m x 160m) and late Bronze Age activity in the form of troughs with burnt clay and stone were also excavated on site. At Coneykeare 1 two very tentative structures were identified by the director and a fifth concentration of activity, incorporating burnt mounds and settlement activity; was noted at Coolnakisha 1. A five post, L-shaped possible temporary structure at Coolnakisha 1 was identified along with two pits containing burnt bone and a moderate amount of charcoal and flint. A spread, also containing a moderate amount of charcoal, burnt bone, flint and heat-shattered stones was located to the north-west of the possible structure. It is most likely that the burnt bone deposits within the features on this site are domestic in nature.

The Northern Landscape; Funerary and Ritual activity

Funerary evidence is represented by ringditches at Kellymount 5 and Paulstown 1 and simple pit cremations also at Paulstown 1. Evidence of the Bronze Age is present at Croan (Aghaviller Parish); where a food vessel was discovered, and also at Cruttenclough; where artefacts of amber, gold and bronze were found; there were 14 gold beads discovered with varying decoration together with graduated amber beads (Lyng 1984). The find circumstances of these artefacts is unknown however similar artefacts in the form of a necklace were discovered at Tara, around the neck of an adolescent male, buried in a pit (Herity and Eogan 1977) and it is likely that the Cruttenclough finds came from a similar burial context. They indicate trading links with Europe and a bronze sunflower pin was also discovered in this townland, which is of late Bronze Age type (Lyng 1984; Eogan 1974a, 87) and originally had a gold foil covering. Other material demonstrating a late Bronze Age presence in the area includes the large hoard from Ballytegan, Co. Laois (Eogan 1983); this contained three sunflower (two covered in gold foil) and one disc-headed pin, two socketed axes, a bracelet of twisted strands and a variety of both solid and hollow bronze rings. The rings are characteristic of Eogan's (1974b; 1993) midland province and this hoard demonstrates ritual activity in the region. Early Bronze Age activity is also evident in the adjacent area of Co. Carlow on the east side of the River Barrow. A cist burial at Killinane contained cremated bone and an upright tripartite bowl food vessel (Moore 1984). Similar discoveries were also found close by in Sliguff and Wells; both townlands are located in west Carlow along the Kilkenny border close to the landscape of the present scheme. The Sliguff cist contained a crouched inhumation that was accompanied by a bowl while the pit cemetery at Baunogenasraid was inserted into the mound of the earlier Linkardstown tomb (Raftery 1974). A large cemetery mound at Ballon Hill was discovered in the 19th century, which revealed a large assemblage of vases and collared urns in both pit and cist burials (Waddell 1990, 51–53).

Six of the sites in this northern landscape of the N9/N10 Phase 4 had evidence for prehistoric funerary activity which was represented by barrows, ringditches, cists and cremation deposits at Rathcash East 1, Garryduff 1, Paulstown 1–2, Kellymount 5, and Coolnakisha 1–2. This evidence broadens the funerary landscape of the Bronze Age in this region. A possible ringditch was recorded at Rathcash East 1. It was formed by two very shallow curvilinear cuts creating a circle with a diameter of 6m and potential openings or entrances (1.45m wide) mirroring one another on the south-east and north-west sides. Nearby activity included a hearth and possible refuse pit. It

is possible that this domestic activity was related to funerary practices associated with the ringditch; however, it is perhaps more plausible that, given the lack of associated burial activity (although the enclosed area had been truncated) and the occurrence of two entrances, the ringditch in fact represents a domestic structure.

At Garryduff 1 two unroofed structures, both comprising arcs of post- and stakeholes, may have been associated with a large, northwest–southeast pit (2m x 1.3m x 0.16m) located close to Structure 1. This pit contained a charcoal-rich deposit with burnt bone, heat-cracked stones and charred hazelnuts which had been deliberately deposited. Three postholes also containing similar material in their fills were arranged around the pit and a definite concentration of burnt bone was noted in this area of the site. It is possible that this pit and the adjacent postholes represent the remains of a draught pit for a pyre with the postholes at either side being used to stabilise the pyre structure for the duration of the process. Two cremation pits were located outside the enclosure which contained quite large chunks of human bone and possible pyre material.

The cemetery complex at Paulstown 1 consisted of both pit and cist burials. Three small cists (averaging 0.6m by 0.32m by 0.16m internally) were made expediently with slabs and blocks of local stone. Three other pits were less formally lined with stone. Each contained cremations but one cist produced two discrete deposits. Three other grave pits formed part of the cemetery. In one of these pits an unburnt human skull was placed on top of a washed cremation deposit. Several burials were accompanied by ceramic gravegoods. These gravegoods included burnt sherds from bipartite vases, a miniature cordoned urn and a miniature vase; a burnt flint scraper as well as charred seeds and hazelnuts also came from one of the cists. The largest grave at Paulstown consisted of a large pit or pits. This contained a complex sequence of deposition which appears to have begun with a circular pit which contained an inverted vase; this was disturbed by the insertion of Vessel 1, another inverted vase which survived intact. A miniature vase (No. 6) may have accompanied one of these burials. Subsequently, a second larger pit extended the grave to the south. The fragmentary remains of three pots (No.s 3–5) were deposited on the base of this pit and a large cremation deposit was placed over them. This deposit contained sherds from Vessels 5 and 6 as did a final silty fill. The evidence suggests that the grave was extended to accommodate burials disturbed from other graves. A large circular pit occurred on the edge of the cemetery (1.55m by 1.48m by 0.80m deep). This had originally been maintained as an open feature that filled naturally with water. Subsequently, a complex sequence of layers containing charcoal, burnt and unburnt bone, charred hazelnut shells and seeds, antler and flint (including flakes, blades and debitage), developed or was deposited in the pit. The proximity of this feature, which appears to have been a well, suggests that it was associated with the funerary activity on the site.

A double ringditch was identified at Kellymount 5. The external ringditch (12m diameter x 1.04m deep) was lined with a spread of burnt mound material, possibly relating to the earlier use of the site as a burnt mound complex. The only artefacts in this external ringditch consisted of three Bronze Age pottery sherds. The internal ringditch (5.6m diameter x 0.2m deep) was situated centrally within the external ringditch and also contained heat-shattered stones in its fills. A central pit had burnt bone inclusions. A further two pits were located to the south of the ringditches and both contained burnt bone inclusions. A substantial part of a vase urn came from one of the troughs associated with the burnt mound complex; while this may be derived from the funerary activity it is evident that the vessel had been used in a domestic context and may have been a deliberate deposit in the base of the trough.

Evidence for funerary activity was also excavated at Coolnakisha 2, where one pit (0.33m x 0.26m x 0.13m) contained 25.5g of charcoal, 0.1g of charred seeds and 390.3g of burnt bone. Other pits and possible pits and spreads also contained burnt bone inclusions, although in much smaller quantities. Both sites produced small quantities of probably middle Bronze Age while residual Neolithic material in the form of three flint scrapers came from Coolnakisha 1.

It is therefore apparent that the central, northern part of Kilkenny contained the most varied evidence for burial and funerary activity. As the N9/N10 progresses northwards sites with a probable continuity of function and chronology emerge: from the Danesfort complex near the King's River to the varied ringditches and cremations at Templemartin 5 and the amalgamation of ritual and burial at Paulstown 1–2.

The Northern Landscape; Burnt Mound Activity

The evidence from the northern landscape, was dominated by clusters of burnt mounds and reinforces the patterning already indicated by the previously known archaeological record. Several previously identified burnt mounds were recorded in Cloghoge (KK020-039, KK020-075,076), Rathcash West (KK020-077,078), Shankill (KK016-003, KK016-010) and at Moanmore (meaning 'great bog') (CW015-007, CW015-014). Twenty seven sites with evidence of burnt mound activity were uncovered as part of the N9/N10 Phase 4 excavations within the northern landscape. The underlying limestone geology/glacial drift consisted of sandy/gravel-clays which have a higher moisture content than the southern and central landscapes resulting in a high water table in localised areas. This helps explain the presence of the considerably sized waterholes at these burnt mound sites, notably within the Jordanstown and Kellymount cluster (Jordanstown 2 & 3 and Kellymount 1-3, 5 & 6). Other clusters of burnt mound activity in the northern landscape occurred at Ballyquirk 1, 2 & 4, Moanmore 1 & 3, Moanduff 1, 2 & 3, Rathcash 1 & 2, Blanchvillespark 2, 3 & 4 and Cranavonane 1 & 2. Other sites exhibiting burnt mound activity include Shankill 6, Bannagagole 1, Rathcash East 2, Tomard Lower 1 and Ballinvally 1. Due to poor on-site conditions, the sites at Cranavonane 2 and Blanchvillespark 2 were not fully resolved but were identified as burnt mounds. Burnt mounds were not excavated at Kellymount 1, Moanduff 2 & 3, Ballyquirk 1 and Ballinvally 1; however features associated with burnt mound activity were recovered and excavated at these sites indicating a clear association with this type of activity.

The Northern Landscape; Route-ways and communications

While it is clear that the rivers and streams are a major feature of the settlement networks, the distribution of prehistoric activity, for example on the lowland fringes to the south of the Castlecomer Plateau, shows that other route-ways were functioning at both a local and regional scale. Within these network systems it is possible to identify particular concentrations of human activity. Some of these were already important in the early Neolithic while others became prominent only in the Bronze Age. Among the most significant of these are those in the area around Carlow, on the upper Barrow and its tributary the Burren River, which the archaeological work on the Carlow Bypass has highlighted (Dunne 2007). To the south of this, the eastern side of the Barrow in the Goresbridge area formed the core of a settlement zone that in the Bronze Age extended westwards across the river into the Paulstown area of Co. Kilkenny. The immediate environs of Kilkenny City also appear in the Bronze Age as a settlement focus, underlined as a result of the N9/N10 excavations, while the southern end of the Castlecomer Plateau, with the major focal site on Freestone Hill, has been highlighted by the discovery of new sites on the lowlands immediately to the south around Rathcash.

The Northern Landscape; Conclusions
In the northern part of the region, focussed on the uplands of the Castlecomer Plateau and the flanking valleys of the Nore and Suir, intense settlement is indicated by both burnt mounds and barrows. The burnt mounds are focussed in the upland area and especially along the river and stream valleys, such as at Clashduff, Coan West and Muckalee on the Dinin and Douglas Rivers, and in the upland hinterland of Freestone Hill. Along the lower part of the Nore Valley, and concentrated in the Foulksrath and Jenkinstown areas, the landscape is dominated by barrows (in this case more specifically ringditches). The contrasting locations of these site types most probably relate to differential landscape exploitation by the same communities with some activities, possibly associated with the seasonal use of upland pasture, confined to higher terrain and settlement and funerary activity taking place in the more sheltered lowlands. The large number of burnt mounds discovered on the lowland fringe to the east of the plateau, along the Barrow Valley, shows the development of intensive settlement throughout the northern part of the region. In this area the hillforts appear to be positioned to overlook the settlement landscape.

3.2.2 The Site Specific Archaeological Landscape of Jordanstown 3

There are no previously recorded monuments dating to the prehistoric period in the vicinity of Jordanstown 3. Located *c*. 1km to the north-west a possible souterrain and a 16/17th century house (KK016-009001, 002) are recorded. The possible site of a linear earthwork (KK021-006) is located *c*. 1.2km to the north and the site of a dwelling (KK016-012) is recorded *c*. 1.25km to the north-east. To the south, *c*. 900m away an enclosure site (KK021-002) is also recorded.

At Jordanstown 3 burnt mound activity consisting of a trough, associated stakeholes and pits and a natural pool dating to the early Bronze Age was excavated. A number of sites were excavated to the north-west and the north-east of Jordanstown 3, as part of the N9/N10 Phase 4: Knocktopher to Powerstown works. Kellymount 6 was located *c*. 80m to the north-west, and a burnt mound complex dating to the early and late Bronze Age periods was excavated indicating continuity of use at the site. Kellymount 2 was located *c*. 220m to the north, and a burnt mound complex including a large pit interpreted as a rainwater reservoir, a trough, four pits, and a possible structure were sealed by a thin layer of burnt mound material. This site appears to have been multi-phased and has returned an early Bronze Age date for one of the pits, a middle Bronze Age date for the trough and a late Iron Age date for the lower fill of the reservoir. The fragment of an amber bead was also retrieved from the reservoir pit and has been dated to the Bronze Age period. Kellymount 1 was located *c*. 200m to the north-east and a pit and a pit/hearth were uncovered during the course of excavations. Heat-shattered stones found in the pit indicated the possible presence of a burnt mound site in the area and an early Bronze Age date has been returned for the site. At Kellymount 3, located *c*. 400m to the north-east, a multi-phased burnt mound site was also excavated. It consisted of a large pit, interpreted as a waterhole / reservoir, five troughs and six circular-/oval-shaped pits. A possible windbreak was identified, which was associated with one of the troughs. An early Bronze Age date and an early-middle Iron date has been returned for two of the troughs, and a middle Iron Age date has been returned for the basal fill of one of the pits.

A number of sites were also excavated to the south-east and south-west of Jordanstown 3, as part of the N9/N10 Phase 4: Knocktopher to Powerstown works. At Paulstown 2, located *c*. 750m to the south-east, late Neolithic and early Bronze Age activity was excavated at the site. Middle Neolithic pottery sherds and Beaker pottery sherds were recovered from the site. Additionally, three post circles associated with the Beaker phase of activity at the site were excavated as well as various other features. A kiln also excavated at the site has returned a middle Iron Age date,

indicating a later phase of activity at the site. At Paulstown 1, located *c.*1km to the south-east, an early to middle Bronze Age mixed cemetery was located. At least 25 burials were uncovered and these included cists, partially stone-lined graves, burials accompanied by pottery vessels and a variety of pit burials. Apart from a disarticulated skull that accompanied one of the pit burials, all of the burial remains took the form of cremation deposits. A small ringditch to the east of the main cemetery area was likely to be associated and contemporary. A great many other features in the area may have also been related to this funerary activity. A trough also excavated at the site returned an early Iron Age date. Jordanstown 2 was located *c.* 250m to the south-west and burnt mound activity dating to the early Bronze Age was excavated as well as early medieval activity in the form of pits, post holes and hearths. Additional features such as hearths, a cobbled surface and a figure of eight shaped kiln were also excavated at the site. A structure and associated features such as pits, stakeholes and postholes were excavated at Jordanstown 1 located *c.* 750m to the south-east and an early Bronze Age date has been returned for the structure. Additionally, a middle Iron Age date has been returned for a shallow pit at the site indicating the site had a number of phases of occupation. At Kilmacahill 2, located *c.* 1km to the south-west, several groups of postholes and stakeholes that may represent temporary prehistoric structures were excavated. A further pit was identified at the centre of the site, which contained a significant amount of early Bronze Age pottery sherds. Dates returned from the site indicate early Neolithic activity, as well as early, middle and late Bronze Age activity suggesting the site had a continuity of use in prehistory.

3.3 Typological Background of Burnt Mounds

Burnt mound sites (also commonly referred to as *fulacht fiadh*) are one of the most common field monuments found in the Irish landscape. The last published survey (Power *et al*. 1997), carried out over a decade ago, recorded over 7,000 burnt mound sites and in excess of 1,000 sites have been excavated in recent years through development led archaeological investigations. In spite of this no clear understanding of the precise function of these sites has been forthcoming.

Burnt mound sites are typically located in areas where there is a readily available water source, often in proximity to a river or stream or in places with a high water table. In the field burnt mounds may be identified as charcoal-rich mounds or spreads of heat shattered stones, however, in many cases the sites have been disturbed by later agricultural activity and are no longer visible on the field surface. Nevertheless even disturbed spreads of burnt mound material often preserves the underlying associated features, such as troughs, pits and gullies, intact.

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

Burnt mound sites are principally Bronze Age monuments and reach their pinnacle of use in the middle/late Bronze Age (Brindley *et al*. 1989–90; Corlett 1997). Earlier sites, such as Enniscoffey Co. Westmeath (Grogan *et al*. 2007, 96), have been dated to the Neolithic and later sites, such as Peter Street, Co. Waterford (Walsh 1990, 47),

have been dated to the medieval period. Thus although burnt mound sites generally form a component of the Bronze Age landscape, the use of pyrolithic technology has a long history in Ireland.

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

3.4 Summary of the Excavation Results

The excavation identified the remains of an early Bronze Age burnt mound. A small sub-oval trough was recorded that was probably originally lined, as evidenced from a series of small stakeholes around the perimeter of the base, although no lining survived *in situ*. Adjacent to the trough was a small pit and two considerably larger pit features which were connected by a shallow channel. It is thought that the larger pits may have had a function related to water management or storage. A very small burnt spread was identified and it is likely that the remainder of the burnt deposit was probably removed or disturbed in antiquity.

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

Lithics analysis

The lithic finds from the archaeological investigations at Jordanstown 3, Co. Kilkenny are a piece of flint debitage and a micro disc scraper made of flint. The assemblage dates to the early Bronze Age (Beaker period).

Charcoal and Wood Species identification

A mixed wood assemblage of oak, willow, ash, blackthorn and hazel was recorded from pits C8 and C9. While this material represents the remains of firing events associated with *fulacht fiadh* activity at the site, the exact source of the material is unknown. It is likely to be re-deposited or dumped charred debris from one or more episodes of burning.

Animal Bone Analysis

Twenty five burnt bone fragments recovered from C10, C12, C11 and C4, a series of fills of pit C8 were submitted for examination. The bone samples were assessed and identified to species where possible. Due to the size and fragmented nature of the burnt bone pieces it was not possible to identify 23 fragments to species; whilst two distal phalanx fragments were identified to pig. No definite or statistically detailed

conclusions could be drawn from the burnt bone assemblage retrieved from the site due to its limited size and poor degree of bone preservation.

Petrographical analysis

Samples of stone from the burnt mound material identified course grained red sandstone that was quartz rich. Coarse grained sandstone does not occur in bedrock in the immediate vicinity of the site. The dominant rock type in the area is limestone. It is important to note that these rock types were not necessarily sourced from bedrock. The sample is clearly a shattered cobble, indicating a secondary source, such as in the glacial tills / river cobbles. It is therefore possible that these rocks were sourced locally.

Coarse grained sandstone is typical of fulacht fiadh material (e.g. see Mandal 2004). It is significant that sandstone is the predominant rock type given that, due to the differing underlying bedrock, it would not be the most abundant rock type available, either in outcrop or in the overlying tills. This indicates that sandstones were deliberately being selected for use in preference to the more abundant finer grained rock types in the area.

Radiocarbon Dating

A total of two samples were sent for AMS radiocarbon dating.

The results of the analysis dated ash charcoal from the fill C11 of a trough C8. The 2 sigma calibrated date was 2457–2202BC (UBA 13119).

The results of the analysis dated ash charcoal from the fill C27 of a pit C9. The 2 sigma calibrated date was 2401–2148BC (UBA 13120).

4 DISCUSSION AND CONCLUSIONS

4.1 Discussion

The excavation identified Burnt Mound type activity that has been dated to the early Bronze Age. The surrounding physical landscape is presently under pasture but the identification of a pool adjacent to the sites indicates that it is a wet marginal area. It is felt that the pool represented seasonal flooding, but it may have been more permanently wet in prehistory. The presence of willow in the charcoal assemblage also indicates a wet environment as willow is normally associated with marginal or wet landscapes. Burnt mound sites are often located in wet, marginal landscapes so the presence of a burnt mound type site here is not unusual.

Two contemporary radiocarbon dates were returned from the site, one from the trough fill and one from the overlying mound material. The 2 sigma dates indicate that the site is dated to the early Bronze Age with the overlap between the two dates being the likely date of the site; 2401–2202BC. Burnt mound sites are commonly dated to the Bronze Age.

The site contains many of the elements generally associated with a “classic” burnt mound site. The small oval trough C8 was probably lined, possible with wicker or wattle as evidenced by the series of stakeholes around the perimeter of the base. While it has been outlined that the surrounding area was marginal and wet, the presence of two larger pits may suggest that the precise location of the site may have been slightly drier. It is interpreted that these larger pits may have been for water storage rather than as troughs for heating water. The size of these pits would have required a considerable amount of heated stones to heat water contained within them. The presence of a shallow connecting channel also suggests that they were for water management. The function of the smaller pit on site is unclear but the external postholes to the lined trough may have supported a small structure such as a windbreak.

Given the number of larger features on the site, the size of the overlying mound material appears quite small. It should be noted however that the lined trough was also quite small and would not have required a large amount of heated stone. In addition, the larger pit features were all filled with burnt mound type material, which would have reduced the volume of any overlying mound. Modern agricultural disturbance and possible erosion by temporary flooding may also have reduced the volume of the mound.

A number of small fragments of burnt bone were recovered from the site. These may represent domestic waste and as such suggest that animals were being cooked and eaten at the site. While it is possible that animals were consumed on the site, the presence of the burnt bone should not necessarily be taken as evidence for this, particularly as the fragments are very small and not possible to identify to species. Animal bone can be used in conjunction with wood as a fuel and it is likely that this is the source of the burnt bone on the site.

Two lithic artefacts were recovered from the fills of the trough. Often, burnt mound sites produce little or no finds. It is possible that the micro disc scraper (E3916:004:1) represents a small tool that was used on the site.

The surrounding archaeological landscape contains no previously recorded monuments in the immediate vicinity of the site. However a number of excavations were carried out in the area as part of the N9/N10 Phase 4, and many of these consisted of burnt mound activity dated to the Bronze Age. Of particular note are the

nearby sites of Kellymount 3 and 6 which could have elements contemporary with the early Bronze Age activity at Jordanstown 3 based on radiocarbon dating results. Also of note is Paulstown 2, 750m to the south-east which produced some contemporary radiocarbon dates. This site consisted of three pit circles and large amounts of Beaker pottery. It is possible that Paulstown 2 was a focal point of the early Bronze Age community that occupied Jordanstown 3. The surrounding sites show that the area was intensively occupied throughout the Bronze Age and into the Iron Age, and this suggests that there was a sizeable settlement in the area throughout prehistory.

4.2 Conclusions

There were no prior prehistoric monuments in the immediate area and as such the identification of the site could be viewed as unexpected. However the site is in a marginal and wet landscape, an area where bunt mound sites are typically found. The presence of other burnt mounds in the immediate area confirms that it is an area that was attractive for this type of activity throughout the Bronze Age. The site is important locally as it provides evidence for previously unknown occupation of this landscape in the early Bronze Age

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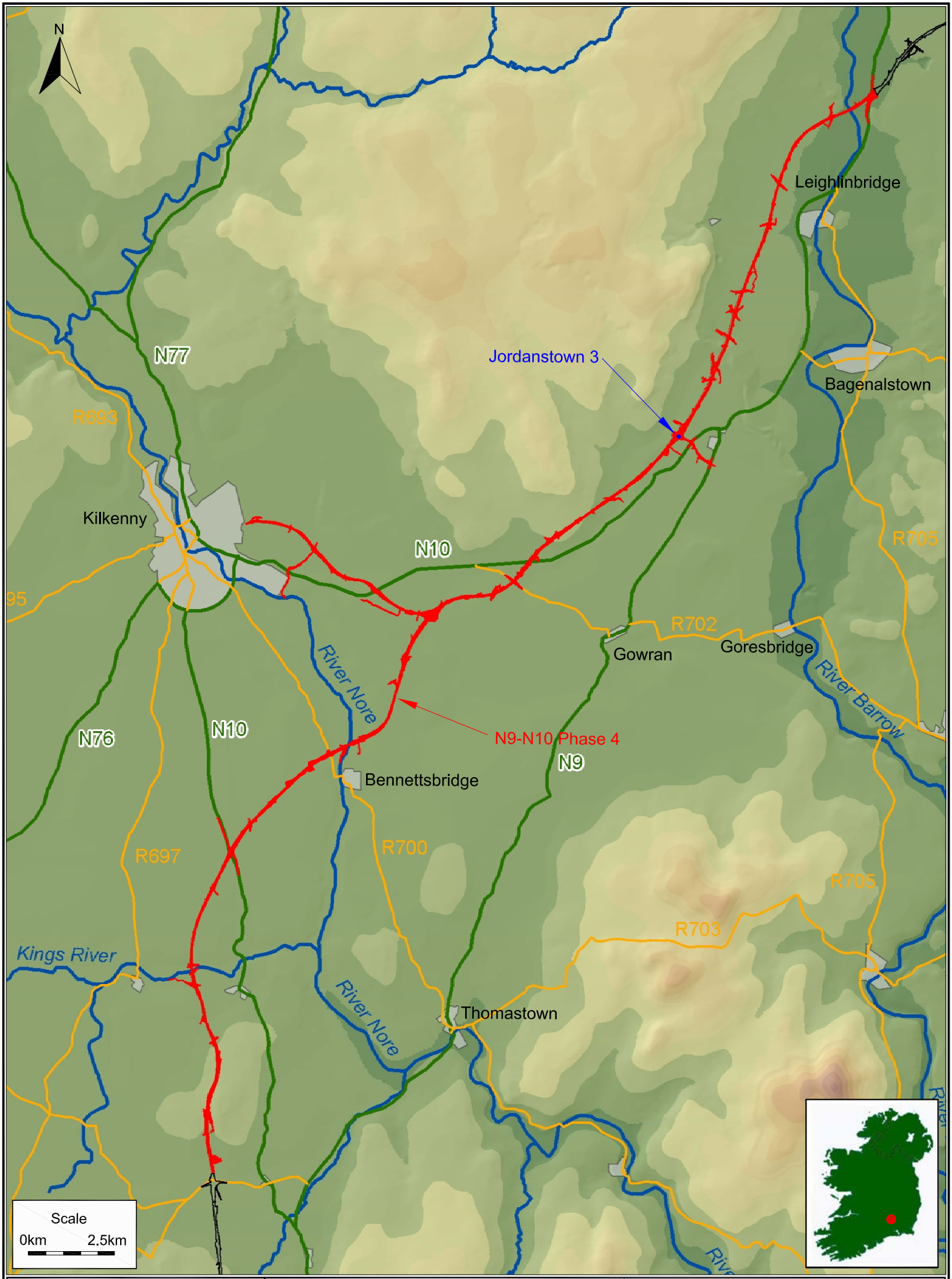

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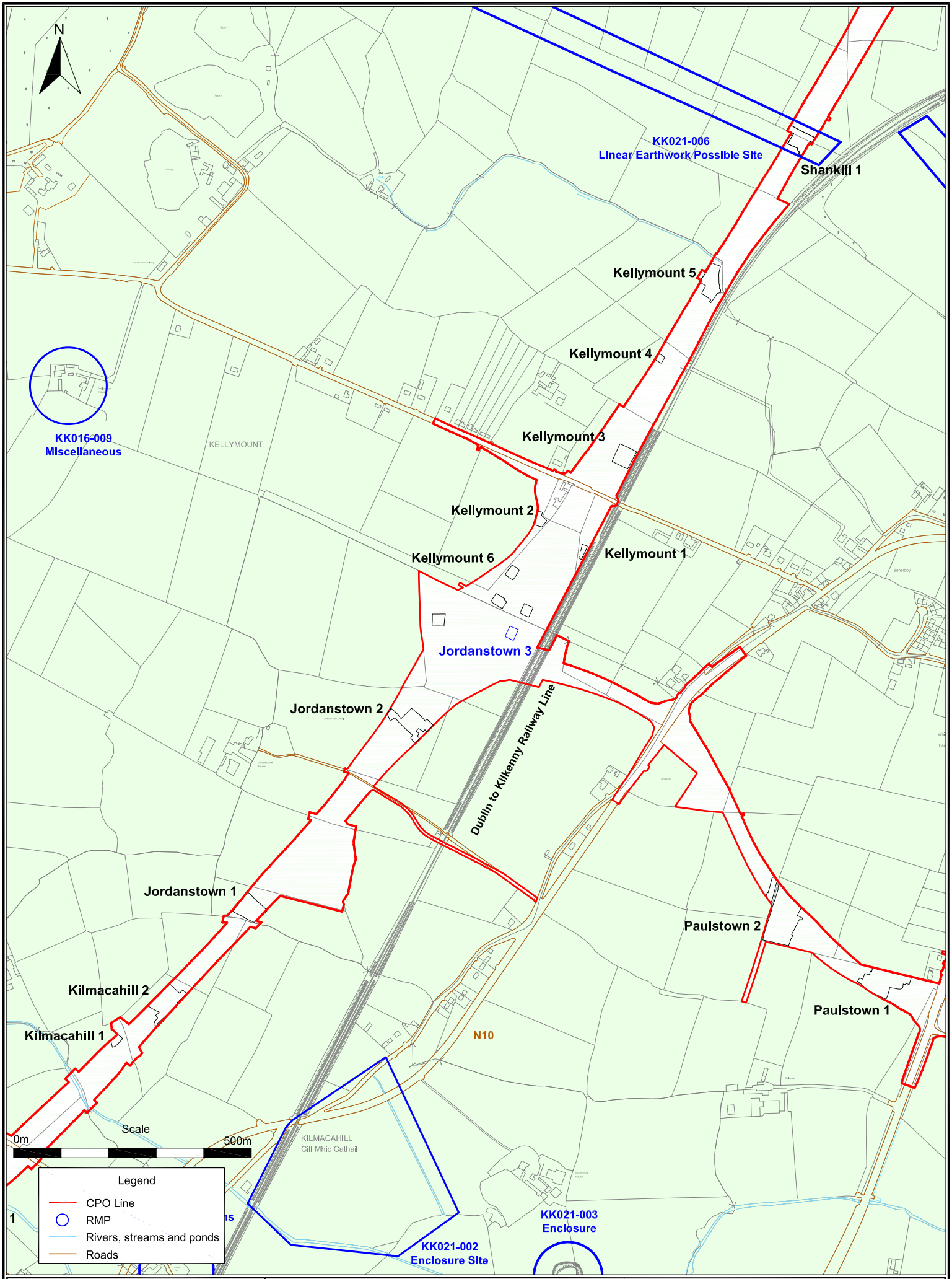

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Project:	N9-N10 Phase 4: Knocktopher to Powerstown
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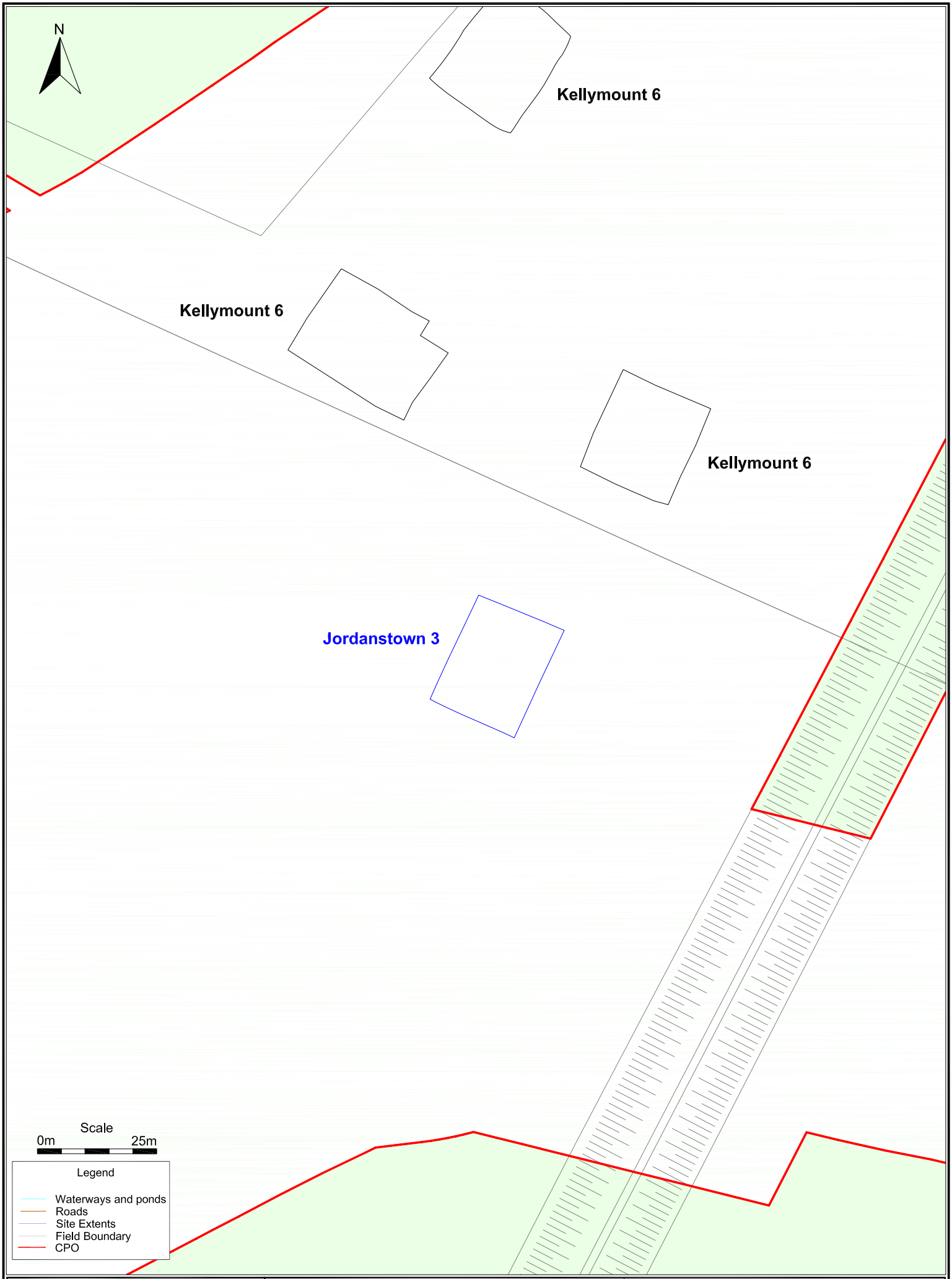

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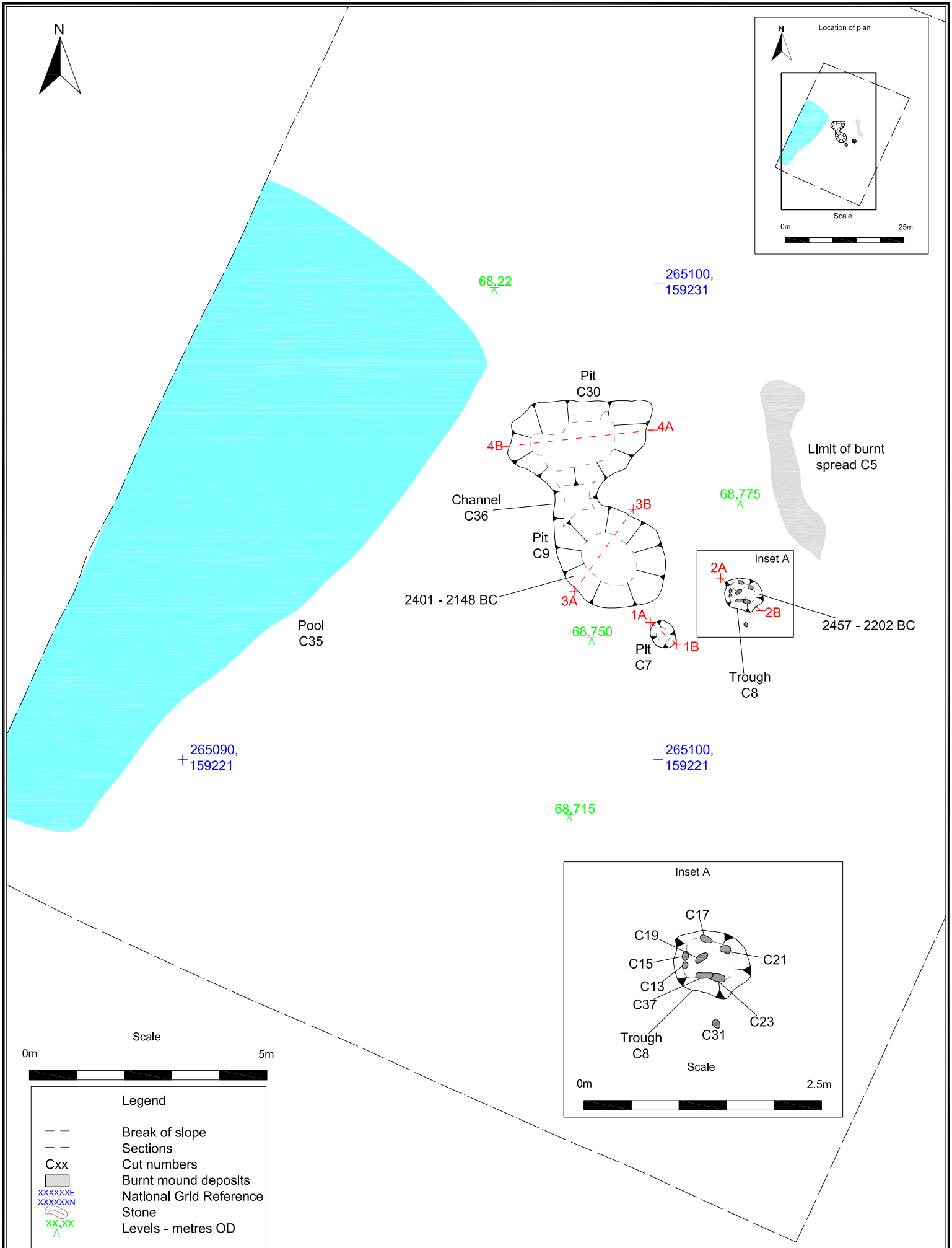

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	Project: N9/N10 Phase 4: Knoctopher to Powerstown	Produced by:	G Kearney
	Client: Kilkenny County Council	Job No:	J2432.1
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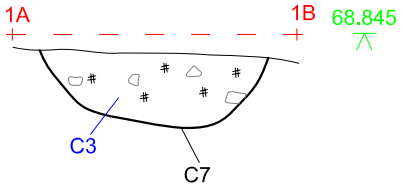

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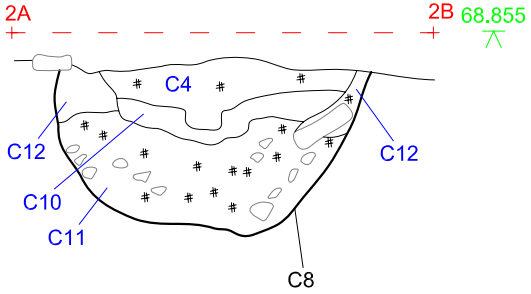

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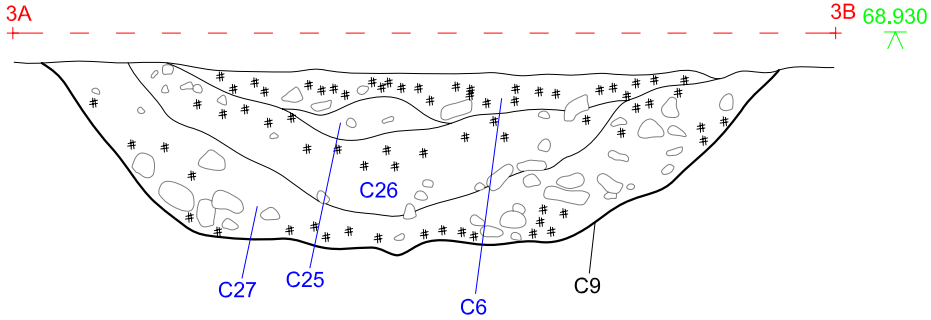
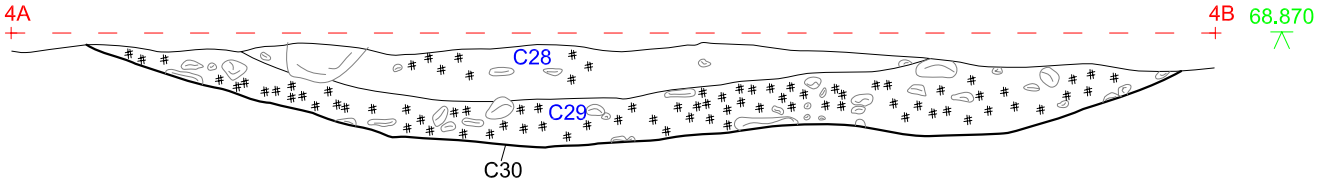


North facing section of C28, C29, C30



Scale

0m 1m

Legend

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

IAC Irish Archaeological Consultancy

Title:	Jordanstown 3 - Sections 1 - 4
Project:	N9/N10 Phase 4: Knoctopher to Powerstown
Client:	Kilkenny County Council

Scale:	1:20 @ A4
Date:	17/06/10
Produced by:	G Kearney
Job No:	J2432.1
Figure No:	5

PLATES

Plate 1: Natural pool located *c.*100m north-west of Jordanstown 3

Plate 2: Pit/ trough C9, mid-excavation, facing north-west

Plate 3: Pit/ trough C9, post-excavation, facing south

Plate 4: Pit C8 with internal stakeholes, post-excavation facing north

Plate 5: Pits C7 and C8 and stakehole C31 (foreground), post-excavation, facing north

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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	NA	NA	NA	NA	Topsoil	Loosely Compacted, Brown to Dark-Brown Sandy-Silt, with moderate stone and high vegetation content. Topsoil quite shallow with frequent roots and cultivation activity	NA	All
C2	NA	NA	NA	NA	Subsoil	Moderately Compacted, Brownish-yellow Sandy-Clay with moderate gravel content	All	NA
C3	C7	0.59	0.5	0.19	Fill of Pit	Mid Compact, Grey Clayey-Silt, with occasional charcoal and moderate burnt stones. Probable association with burnt mound/*fulacht*	C1	C7
C4	C8	0.68	0.55	0.25	Top fill of pit	Loosely Compacted, Brown to Dark-Brown Sandy-silt, with occasional charcoal and burnt bones. High presence of root material within this context.	C1	C12
C5	NA	3.8	0.9	0.15	Spread	Fill of Natural Depression, Crescent shaped NE-SE, Mid Compact, Grey to Dark Grey Sandy-silt with occasional burnt stones and moderate charcoal.	C1	C2
C6	C9	2.4	1.44	0.13	Top Fill of Pit	Loosely Compacted, Dark Brownish-Grey Sandy-Silt with occasional burnt stones and moderate charcoal. Similar to Top Fill (C28) of adjacent pit (C30). Probably associated with *Fulacht*/Burnt Mound	C1	C25
C7	NA	0.59	0.5	0.19	Small oval Pit	Small oval pit, NW-SE. Sharp break of slope at top, concave sides with gradual break of slope and concave base. Probably linked to *fulacht* activity	C3	C2
C8	NA	0.82	0.74	0.47	Oval Pit	Oval Pit, NW-SE. Sharp break of slope at top, vertical sides at S,W,N Mid-Steep slope at E. Gradual break of slope and flat to concave base. The pit contained a number of internal stakeholes and sub-rectangular sockets possibly for worked timbers	C11	C2
C9	NA	2.7	2.06	0.48	Oval Pit	Large Oval Pit, NW-SE. Sharp break of slope at top. Gradual slope of sides and break of base, with slightly concave base. The Fills suggest association with *fulacht* activity.	C27	C2
C10	C8	0.6	0.45	0.08	Mid Fill of Pit	Moderately compacted Greyish to Yellowish Brown, Sandy-Silt. Possibly redeposited natural mixed with ashes. Occasional charcoal and burnt bones.	C4	C12
C11	C8	0.75	0.65	0.31	Bottom Fill of Pit	Loosely compacted, dark grey sandy-silt with moderate charcoal and frequent burnt stones. Similar to base fill (C27) of Pit (C9). Below this fill were several stakeholes and sockets for timbers.	C12	C8
C12	C8	0.15	0.8	0.15	Upper fill of pit	Moderately Compacted, Grey Sandy-Silt with occasional charcoals and burnt bones, and moderate stones (some burnt). This fill formed a ring around the upper inside edges of the pit, the interior of this ring was approx 0.5m in diameter and was filled by (C4) and (C10). Context seems quite similar to base fill (C11) possibly same but more exposed to environmental and agricultural contamination	C10	C11

Context	Fill of	L(m)	W(m)	D(m)	Interpretation	Description	Context Above	Context Below
C13	NA	0.08	0.06	0.13	Stakehole	Small Stakehole oval in shape NE-SW. Sharp break of slope at top, steep to vertical sides, varying break of base and a concave base. Stakehole was located within pit (C8) possibly part of some kind of structure in or over the pit.	C14	C8
C14	C13	0.08	0.06	0.13	Fill of Stakehole	Firmly Compacted, Light to Mid Grey Clayey-Silt with occasional charcoal. Possibly due to process of natural sedimentation	C11	C13
C15	NA	0.09	0.06	0.12	Stakehole	Small Circular Stakehole, Sharp break of slope at top, steep-vertical sides and a concave base. Located within pit (C8) and directly beside stakehole (C13)	C16	C8
C16	C15	0.09	0.06	0.12	Fill of Stakehole	Tightly Compacted, Light-Mid Grey Clayey-Silt with occasional charcoal	C11	C15
C17	NA	0.14	0.07	0.14	Sub-rectangular Stakehole	Oval/Sub-Rectangular NW-SE, cut at base of pit (C8), Clearly associated with the stakeholes in this pit, it is possible that this cut was the remains of a socket for a squared worked timber as opposed to a round stake. Sharp break of slope at top, steep-vertical sides, sharp break at base and a flat base	C18	C8
C18	C17	0.14	0.07	0.14	Fill of Sub-rectangular Stakehole	Tightly Compacted, Light-Mid Grey Clayey-Silt with occasional charcoal. Possibly result of natural sedimentation	C11	C17
C19	NA	0.16	0.08	0.12	Sub-rectangular Stakehole	Small Oval/Sub-Rectangular Cut NE-SW, possibly remains of a socket for a worked piece of timber. Sharp break of slope at top, vertical sides, varying break of basal slope and concave base. Located within pit (C8) and clearly associated with the other stakeholes within the pit. Possibly indication of a structure in or over pit (C8)	C20	C8
C20	C19	0.16	0.08	0.12	Fill of Sub-rectangular Stakehole	Tightly Compacted, Light to Mid Grey Clayey-Silt with occasional charcoal	C11	C19
C21	NA	0.12	0.08	0.09	Sub-rectangular Stakehole	Oval/Sub-Rectangular Cut, within pit (C8), possibly remains of socket for worked/squared timber. Sharp break of slope at top, vertical sides, varying break of base and concave base. Probably part of a structure, and clearly associated with other stakeholes within pit (C8)	C22	C8
C22	C21	0.12	0.08	0.09	Fill of Sub-rectangular Stakehole	Tightly compacted, light to mid-grey clayey-silt with occasional charcoal. Possibly result of natural sedimentation	C11	C21
C23	NA	0.15	0.09	0.18	Sub-rectangular Stakehole	Sub-Rectangular cut within pit (C8), NW-SE, Sharp break of slope at top, steep to vertical sides, varying break at base and flat base. Possibly a socket for a worked/squared piece of timber, associated with similar features/stakeholes in pit (C8) and probably indicative of some kind of structure.	C24	C8
C24	C23	0.31	0.09	0.18	Fill of Sub-rectangular Stakehole	Tightly compacted, Light to Mid-Grey Clayey Silt with occasional charcoal, possibly result of natural sedimentation	C11	C23
C25	C9	0.44	0.30	0.1	Pockets of redeposited subsoil in pit	Moderately Compacted greyish-yellow silty sand, with very occasional charcoal and moderate stones. Irregular pockets of redeposited subsoil in pit (C9). There were two pockets of this fill the largest being 0.44mx0.30mx0.1m and the smaller being 0.3mx0.22mx0.1m	C6	C26
C26	C9	1.8	1.3	0.23	Mid Fill of Pit	Oval NW-SE, Loosely Compacted Grey Sandy-Silt with moderate charcoal and moderate burnt stones. Possibly same as (C27) which lies underneath and was hence somewhat less exposed to environmental contamination than (C26)	C25	C27

Context	Fill of	L(m)	W(m)	D(m)	Interpretation	Description	Context Above	Context Below
C27	C9	2.7	1.93	0.45	Bottom Fill of Pit	Oval NW-SE, Loosely Compacted Dark-Grey Sandy-Silt with frequent burnt stones and moderate charcoal content. Bottom Fill of pit (C9). Probably associated with *fulacht*/burnt-mound activity	C26	C9
C28	C30	2	1.8	0.14	Top Fill of Pit	Oval E-W, Moderately Compact, Greyish-Brown Sandy-Silt with occasional stones and occasional charcoal. Seems to be a mixture of *fulacht* material and topsoil covering burnt deposit (C29)	C1	C29
C29	C30	3.18	2.2	0.2	Bottom Fill of Pit	Irregular/Sub-Oval fill of pit. Moderately compacted mid to dark grey sandy-silt with frequent burnt stones and moderate charcoal. Probable associations to *fulacht*/burnt-mound activities	C28	C30
C30	NA	3.18	2.2	0.27	Sub-Oval Pit	Sub-Oval pit, E-W, gradual break of slope at top, gradually sloping sides and gradual break of base with a flat base. Similar but shallower than pit (C9). The southern edge of this pit intersects slightly with pit (C9). As is the case with pit (C9), pit (C30) is filled primarily with *fulacht* material	C29	C2
C31	NA	0.11	0.07	0.11	Stakehole	Small oval stakehole NE-SW, Sharp break of slope at top except at SE were break of slope is gradual, Vertical sides except at SE were sides are slightly sloping. Break of base is varying and base is concave. Situated just to the SE of pit (C8) and probably associated with this feature.	C32	C2
C32	C31	0.11	0.07	0.11	Fill of Stakehole	Oval, NW-SE, Tightly compacted dark-grey sandy-silt with moderate charcoal content.	C1	C31
C33	C35	*c.*15	*c.*10	0.4	Natural Sedimentation	Oval to circular deposit E-W, of moderately compacted grey sandy-silt with occasional stones and very occasional charcoal. Bottom fill of (C35), Probably natural accumulation of silts washed into this natural depression/pool from other areas of the site. The feature is to the West of (C30) and (C9) which may be the source of the small traces of charcoal within this context	C34	C35
C34	C35	*c.*15	*c.*10	0.15	Natural Sedimentation	Moderately compacted, Greyish-Yellow Clayey-Silt with occasional stones. Upper Fill of Natural Depression (C35), Probably result of natural sedimentation.	C1	C33
C35	NA	*c.*15	*c.*10	0.5	Remains of Natural Pool	Oval/Sub-Circular Natural Depression probably remains of a natural pool. Corners are Rounded-Irregular, Moderate-Gradual Break of Slope at Top, Moderately sloping sides, gradual break of base and an irregular base. Probably filled up over time due to natural sedimentation	C33	C2
C36	N/A	0.90	0.50	0.07	Shallow cut between larger pits	Connecting channel	C1	C2
C37	NA	0.16	0.09	0.18	Sub-rectangular Stakehole	Sub-Rectangular cut within pit (C8), NW-SE, Sharp break of slope at top, steep to vertical sides, varying break at base and flat base. Possibly a socket for a worked/squared piece of timber, associated with similar features/stakeholes in pit (C8) and probably indicative of some kind of structure.	C24	C8

Appendix 1.2 Catalogue of Artefacts

Registration Number	Context	Item No.	Simple Name	Full Name	Material	Description	No. of Parts
E3916:4:1	4	1	Scraper	Flint scraper	Flint	A classic, very small micro disc scraper which had been burnt	N/A
E3916:12:1	12	1	Debitage	Flint debitage	Flint	Flint debitage	N/A

Appendix 1.3 Catalogue of Ecofacts

During post excavation works specific samples were processed with a view to further analysis. Six soil samples were taken from features at Jordanstown 3 and all six 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	Hazelnuts	burnt animal bone	animal bone	human bone	burnt human bone	Heat-affected Stone
4	2	Burnt Deposit in Pit C8			1.0g				
10	4	Burnt Deposit in Pit C8			0.9g				
11	1	Burnt Deposit in Pit C8	58.3g						0.08l
11	5	Burnt Deposit in Pit C8			0.4g				
12	3	Burnt Deposit in Pit C8			0.2g				
27	6	*Fulacht* Material Deposit in Pit C9	68.3g						0.05l

Appendix 1.4 Archive Index

Project: N9/10		
Site Name: AR122 / Jordanstown 3		
Ministerial Number: A032 Reg Number: E3916		
Site director: Przemyslaw Wierzbicki		
Date: 18.01.08		
Field Records	**Items (quantity)**	**Comments**
Site drawings (plans)	2 plans	1 pre-ex, 1 post-ex
Site sections, profiles, elevations	2 section sheets	10 drawings, on 2 sheets
Other plans, sketches, etc.	0	
Timber drawings	0	
Stone structural drawings	0	
Site diary/note books	0	
Site registers (folders)	1	
Survey/levels data (origin information)	58	48 on plans, 10 on sections
Context sheets	35	
Wood Sheets	0	
Skeleton Sheets	0	
Worked stone sheets	0	
Digital photographs	36	
Photographs (print)	0	
Photographs (slide)	0	
Security copy of archive	Yes	Digital

APPENDIX 2 SPECIALIST REPORTS

Appendix 2.1 Lithics Report – Farina Sternke

Appendix 2.2 Charcoal and Wood analysis Report – Susan Lyons

Appendix 2.3 Burnt Bone Report – Aoife McCarthy

Appendix 2.4 Petrographical Report – Dr. Stephen Mandal

Appendix 2.5 Radiocarbon Dates – QUB Laboratory

Appendix 2.1 Lithics Report – Farina Sternke

Lithics Finds Report for E3916
Jordanstown 3 (A032/152), Co. Kilkenny
N9/N10 Road Scheme – Phase 4B

Farina Sternke MA, PHD

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Introduction
Two lithic finds from the archaeological investigations of a prehistoric site at Jordanstown 3, Co. Carlow were presented for analysis (Table 1). The finds are associated with a possible *fulacht fiadh* with associated pits.

Find Number	Context	Material	Type	Condition	Cortex	Length (mm)	Width (mm)	Thickness (mm)	Complete	Retouch
E3916:004:1	4	Flint	Retouched artefact	Burnt	No	13	13	5	Yes	Right, left & distal direct abrupt
E3916:012:1	12	Flint	Debitage							

Table 1 Composition of the Lithic Assemblage from Jordanstown (E3916)

Methodology
All lithic artefacts are examined visually and catalogued using Microsoft Excel. The following details are recorded for each artefact which measures at least 20mm in length or width: context information, raw material type, artefact type, the presence of cortex, artefact condition, length, with and thickness measurements, fragmentation and the type of retouch (where applicable). The technological criteria recorded are based on the terminology and technology presented in Inizan *et al.* 1999. The general typological and morphological classifications are based on Woodman *et al.* 2006. Struck lithics smaller than 20mm are classed as debitage and not analysed further, unless they are retouched or of specific significance, e.g. cores etc. The same is done with natural chunks.

Quantification
The artefacts are two worked flints, one of which (E3916:004:1) is retouched and was therefore recorded in detail.

Provenance
The finds were recovered from contexts C4 and C12.

Condition:
The retouched lithic survives in burnt, but complete condition.

Technology/Morphology:
The lithic is a retouched flake which measures 13mm in length, 13mm in width and 5mm in thickness. It is a classic, very small micro disc scraper.

The second lithic is a piece of debitage.

Dating:
The micro disc scraper is typologically diagnostic, and dates to the early Bronze Age.

Conservation
Lithics do not require specific conservation, but should be stored in a dry, stable environment. Preferably, each lithic should be bagged separately and contact with other lithics should be avoided, so as to prevent damage and breakage, in particular edge damage which could later be misinterpreted as retouch. Larger and heavier items are best kept in individual boxes to avoid crushing of smaller assemblage pieces.

Discussion
The size and composition of the flaked assemblage is typical for Irish burnt mounds. Recent excavations in the south-east of Ireland revealed a similar pattern of very small assemblages found in associated *fulachta fiadh*, e.g. the N25 Waterford By-Pass (Woodman 2006). These assemblages are dominated by the use of local remanié or imported nodules of beach pebble flint which is often worked using the bipolar method (see also O'Hare 2005).

Conclusion
The lithic finds from the archaeological investigations at Jordanstown 3, Co. Kilkenny are a piece of flint debitage and a micro disc scraper made of flint. The assemblage dates to the early Bronze Age.

This site makes a minor contribution to the evidence for prehistoric settlement in Co. Kilkenny.

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Appendix 2.2 Charcoal and Wood analysis Report – Susan Lyons

Site Name- Jordanstown 3
Excavation number –E3916 AR122
County – Kilkenny
Author- Susan Lyons

Date –16/09/09

Charcoal Identification Report

Illustrations

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Introduction
Two charcoal samples were identified and analysed from excavations associated with burnt mound activity at Jordanstown 3, Co. Kilkenny as part of the resolution of the N9/N10 Kilcullen to Waterford Scheme, Phase 4B – Rathclogh to Powerstown. The site contained the remains of a burnt mound along with a series of pits and stakeholes all of potential prehistoric date (Wierzbicki, 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 charcoal identified can also 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 charcoal report serves as a summary report only for Jordanstown 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
Two charcoal samples from C11 (fill of pit C8) and C27 (fill of pit C9) 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.

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.

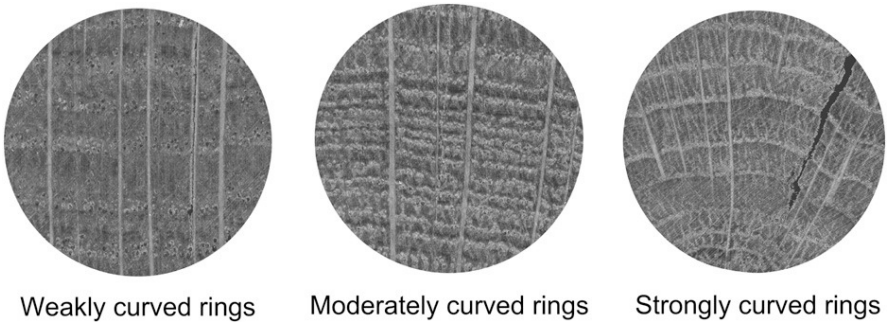

Fig. 1. Ring curvature (after Marguerie and Hunot 2007 1421, Fig. 3)

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

Five wood species totaling 100 identifications were recorded from the samples associated with Jordanstown 3. *Quercus* sp. (oak), was the dominant species identified, followed by much lesser incidences of *Salix* sp. (willow), *Corylus avellana* (hazel), *Fraxinus excelsior* (ash) and *Prunus spinosa* (blackthorn) (Fig. 2).

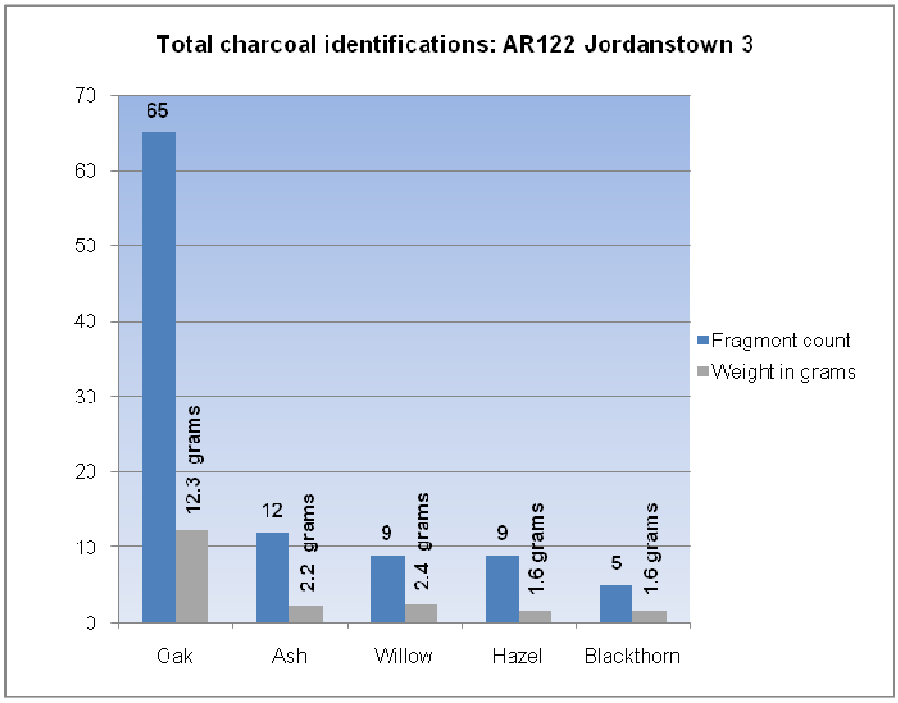

Fig. 2

Discussion

Background and origin of wood species

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).

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*).

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).

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.

Prunus spinosa L. (blackthorn)
Blackthorn is a spiny shrub often found in woodlands where the canopy has been opened up and is quick to colonise clearings and rapidly forms dense thickets, particularly in coastal regions. It is also found near streams, growing close to alder (Orme and Coles, 1985). This species does not usually live beyond forty years and produces new shoots from their roots. When fully matured, its sharp thorns act as a barrier shielding younger trees from grazing animals (Hickie, 2004).

Distribution of charcoal from Jordanstown 3
The number of identifiable charcoal fragments recovered from Jordanstown 3 were localised to just two feature; pit C8 (C11) and pit C9 (C27). Both pits contained a similar wood assemblage. Oak dominanted within each feature, with lesser incidences of ash, willow and blackthorn also identified. Hazel was only present from C11.

The burnt mound/*fulacht fiadh* activity recorded at the site is likely to account for the mixed assemblage recorded from these pits. This mixed assemblage of wood species recorded in varying concentrations makes it is difficult to ascertain the primary source of the material. The periodic dumping of charred remains associated with *fulacht fiadh* activity would inevitably result in the mixing of wood species from different sources representing one or more burning events. It must also be considered that this charred fuel debris would have become distributed across the site to enter open features or become mixed with sealing deposits. A mixed wood assemblage is not an unusual occurrence from *fulacht fiadh*/burnt mound sites and has also been recorded from a number of similar sites excavated along the routeway of the Gas Pipeline, which ran through Counties Dublin, Meath, Westmeath, Galway and Clare (O'Donnell, 2007) as well as from AR109 Blanchvillespark 3 along this scheme (Lyons, 2009).

The results from this site will be later merged and discussed with similar sites also excavated along the N9/N10 scheme.

Summary

A mixed wood assemblage of oak, willow, ash, blackthorn and hazel was recorded pits C8 and C9. While this material represents the remains of firing events associated with *fulacht fiadh* activity at the site, the exact source of the material is unknown. It is likely to be re-deposited or dumped charred debris from one or more episodes of burning.

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Table 1 Charcoal identification results from Jordanstown 3 (E3541)

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
011	001	58.3 grams	Fill of pit C8	Quercus sp. (oak)	33	7.1 grams	4mm - 12mm	3 - 5 rings	weak
				Fraxinus excelsior (ash)	8	1.4 grams	3mm - 7mm	2 - 4 rings	
				Salix sp. (willow)	6	1.4 grams	3mm - 8mm	3 rings	
				Prunus spinosa (blackthorn)	3	0.5 grams	4mm - 6mm	4 rings	
027	006	68.3 grams	Fill of pit C9	Quercus sp. (oak)	32	5.2 grams	4mm - 15mm	2 - 8 rings	weak
				Corylus avellana (hazel)	9	1.6 grams	3mm - 7mm	3 - 5 rings	
				Fraxinus excelsior (ash)	4	0.8 grams	4mm - 6mm	2 - 4 rings	
				Salix sp. (willow)	3	1 gram	5mm	3 rings	
				Prunus spinosa (blackthorn)	2	1.1 grams	3mm	3 rings	

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Appendix 2.3 Burnt Bone Report – Aoife McCarthy

Osteoarchaeological Report of Burnt Bone from
E3916: Jordanstown 3 AR122
Co. Kilkenny
N9/N10 Kilcullen to Waterford Scheme
Phase 4b: Knocktopher to Powerstown
Author: Aoife McCarthy MA BA
Date: February 2010

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1. Introduction

1.1 Introduction

This report details the osteological analysis of burnt bone samples recovered during excavations at Site E3916 AR122 Jordanstown 3 in the townland of Jordanstown, Co. Kilkenny 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 February 2010. At the time of writing this report, background archaeological information was obtained from a draft interim excavation report (Wierzbicki, P. 2009) and from consulting the original site register documents.

1.2 General Osteological Information

The osteological analysis of burnt bone fragments recovered during sieving of bulk soil samples 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 25 fragments from 24 possible skeletal elements and weighing 2.97g were recorded within the assemblage. The degree of preservation of the burnt bone assemblage was poor. A modest rate of fragmentation was noted within the assemblage.

The burnt bone material originated from a series of 4 archaeological contexts including; C10 the sandy silt mid fill of pit feature C8, C12 the moderately compacted upper fill of pit feature C8 as well as C4 the dark brown sandy silty top fill of pit feature C8 and C11 the loosely compacted bottom fill of pit C8.

Two charcoal samples retrieved from archaeological contexts C11 and C27 were classified to species and issued for AMS dating. A sample of ash charcoal from burnt deposit C11 returned a two sigma calibrated date of Cal. 2457–2202BC; whilst ash charcoal identified within *fulacht* material C27 returned a two sigma calibrated radiocarbon date of Cal. 2401–2148BC, placing both features within the early Bronze Age period.

Two burnt bone fragments (8%) were classified to species. Due to fragmentation combined with poor preservation and small size of individual bone fragments it was not possible to identify 23 fragments (92%) these were classed as indeterminate vertebrate of small, medium or large size. Bone elements were identified where possible.

The burnt bone assemblage recovered from Jordanstown 3 contained bone from a single identifiable 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. The closely related taxa of sheep and goat are difficult to distinguish and where grouped under the term '*caprinae*'

- 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 Jordanstown 3 ageing was not possible.

BIOMETRICAL DATA: Due to the high degree of fragmentation and small size of the burnt bone remains recovered measurements were taken but biometrical data interpretation was not possible.

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 and the nature of the bone material recovered from Jordanstown 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 4
A total of 10 burnt bone fragments (1.14g) representing 10 possible skeletal elements were identified within C10 the moderately compacted sandy silt mid fill of pit feature C8. Small fragment size combined with a poor degree of preservation meant it was not possible to identify species of the 10 bone fragments (40%). Skeletal elements were identified where possible.

Indeterminate Vertebrate
Due to a high degree of fragmentation and minute size the rib and skull fragments recovered from C10 were not identified to species. All 10 bone fragments exhibited evidence of exposure to a high level of heat and consequential calcination in the form of alteration of bone surface colour to white and grey white, combined with cracking of remaining bone surface. Bone structure changes through exposure to heat with a

white or pale grey colour indicating exposure to temperatures in excess of *c.* 600°C combined with a ready oxygen supply (McKinley, 2004). As detailed by Luff & Pearce in 1994 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. Such distortion to the bone structure reduces its size and as detailed above alters bone colour (Luff R. & Pearce J. 1994).

Context 11 Sample 5
A single calcined long bone diaphysis fragment (0.45g) of a small size mammal was recovered from C11 the loosely compacted sandy/silty bottom fill of pit feature C8. The small fragment size combined with a poor degree of preservation meant it was not possible to identify species of the bone fragment (4%).

Indeterminate Vertebrate
A high degree of fragmentation and minute size the long bone diaphysis fragment recovered from C11 the loosely compacted bottom fill of pit feature C8 was not identified to species. The fragment measured 14mm in length, 8mm in width and 4mm thick. The diaphysis fragment displayed evidence of exposure to a high level of heat and resulting calcination in the form of bone surface colour change to white, combined with bone surface cracking. As Devlin J.P. & Herrmann N. P (2008, 109) state "increasing exposure to heat bone progresses through a sequence of colours from unburned tan, to shades of dark brown to black, progressing to blue and grey and finally to white."

Context 12 Sample 3
Two calcined rib corpus fragments (0.31g) of a small size mammal were retrieved within C12 the moderately compacted grey sandy upper fill of pit feature C8. Poor preservation combined with small fragment size meant it was not possible to identify species of the two corpus fragments (8%).

Indeterminate Vertebrate
A high degree of fragmentation and small size the two rib corpus fragments recovered from C12 the moderately compacted upper fill of pit feature C8 was not identified to species. The larger of the two fragments measured 22mm long, 4mm wide and 3mm thick. The fragments displayed evidence of exposure to a high level of heat and resulting calcination in the form of bone surface colour change to grey-white, combined with bone surface cracking.

Context 4 Sample 2
A total of 12 burnt bone fragments (1.07g) representing 11 possible skeletal elements were retrieved from C4 the dark brown sandy-silt top fill of pit feature C8. The small fragment size combined with a poor degree of preservation meant it was not possible to identify species of 10 fragments (40%). Skeletal elements were identified where possible. Two calcined phalanx fragments were identified to pig.

SUS/PIG
Two poorly preserved calcined fragments of distal phalanx (0.38g) were recovered. Both fragments displayed a glossy bone surface combined with colour change to grey. Measurements of the larger fragment were recorded at 12mm long by 6mm wide and 3mm thick. Bone structure changes through exposure to heat with a white or pale grey colour indicating exposure to temperatures in excess of *c.* 600°C combined with a ready oxygen supply (McKinley, 2004). Such distortion to the bone structure reduces its size and as detailed above alters bone colour (Luff R. & Pearce J. 1994).

Indeterminate Vertebrate

Due to a high degree of fragmentation and minute size the rib and long bone diaphysis fragments recovered from C4 were not identified to species. All 10 bone fragments exhibited evidence of exposure to a high level of heat and consequential calcination in the form of alteration of bone surface colour to white and grey white, combined with cracking of remaining bone surface. Measurements were recorded for the calcined long bone diaphysis fragment which was 9mm long, 8mm wide and 4mm thick. As Devlin J.P. & Herrmann N. P (2008, 109) state "*increasing exposure to heat bone progresses through a sequence of colours from unburned tan, to shades of dark brown to black, progressing to blue and grey and finally to white*." A quantity of the unidentifiable bone fragments recovered consisted of small–tiny fragments of trabecular bone.

4. Summary

Twenty five burnt bone fragments recovered from archaeological contexts C10, C12, C11 and C4 a series of fills of pit feature C8 on Jordanstown 3 were submitted for examination. The bone samples were assessed and identified to species where possible. Due to the size and fragmented nature of the burnt bone pieces it was not possible to identify 23 fragments to species; whilst two distal phalanx fragments were identified to pig. No definite or statistically detailed conclusions could be drawn from the burnt bone assemblage retrieved from Jordanstown 3 due to its limited size and poor degree of bone preservation. No finds were recovered from pit feature C8.

Two charcoal samples retrieved from archaeological contexts C11 and C27 were classified to species and issued for AMS dating. A sample of ash charcoal from burnt deposit C11 returned a two sigma calibrated date of Cal. 2457–2202BC; whilst ash charcoal identified within *fulacht* material C27 returned a two sigma calibrated radiocarbon date of Cal. 2401–2148BC, placing both features within the early Bronze Age period.

Bone Database:

Spec	C	S	Taxa	Anat	Side	Prox	Dist	1	2	3	4	5	6	7	8	But	Bu	G	Q	W (g)	Comments
1	C10	4	Unid	Rib													G, W		6	0.38	Series of small poorly preserved fragments of rib corpus. Trabecular bone exposed. Bone surface also cracked.
2	C10	4	Unid	Skull													B, W		4	0.76	Calcined fragments of skull, poor preservation degree of trabecular bone exposed also. Degree of bone although calcined is also blackened. Largest fragment Length 11mm, Width 10mm, Thickness 8mm
3	C12	3	Unid	Rib						1	1						W, G		2	0.31	Calcined rib corpus fragments, bone surface cracked. Larger fragment Length 22mm, Width 4mm, Thickness 3mm. Possible rodent, small size.
4	C4	2	Unid	Rib													W, G		5	0.19	Series of small poorly preserved fragments of rib corpus. Bone surface of fragments cracked. Trabecular bone exposed.
5	C4	2	Pig Size	Phalanx									1				G		2	0.38	Calcined, glossy surface distal phalanx fragments. Larger fragment Length 12mm, Width 6mm, Thickness 3mm
6	C4	2	Unid	Unid													W		1	0.09	Calcined fragment of trabecular bone
7	C4	2	Unid	Long Bone													W		1	0.21	Calcined diaphysis fragment, bone surface cracked and degree of trabecular bone exposed. Length 9mm, Width 8mm, Thickness 4mm
8	C4	2	Unid	Unid													W		3	0.20	Calcined fragments, of bone, moderate preservation. Small size mammal.
9	C11	5	Unid	Long Bone													W		1	0.45	Calcined long bone fragment of small-med size mammal. Fragment Length 14mm, Width 8mm, Thickness 4mm

Key:

C= Context
S=Sample
Spec=Specimen
Cn=Carnivore
But=Butchery
Bu=Burnt
Anat=Anatomical Element
Prox=Proximal
N=No
Unid=Unidentifiable
G=Gnaw
Q=Quantity of Pieces
W=White
R=Rodent
Taxa=Taxon
B=Black

Dist=Distal G=Grey W (g) = Weight in grams

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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 Petrographical Report – Stephen Mandal

Petrographical Report on Stone Samples
Taken During Archaeological Excavations
at Jordanstown 3 (E3916)

Eurgeol Dr. Stephen Mandal MIAI PGEO

Introduction
This report is based on the macroscopic (hand specimen) examination of stone samples taken during archaeological excavations in advance of the N9/N10 Phase 4b Knocktopher to Powerstown Road Scheme. The purpose of the study was to identify the rock types from which the stone objects were made, to highlight potential sources for them, and to comment on their possible function. It is important to note that macroscopic petrographical studies have been considered of limited value in comparison to microscopic (thin section and geochemical analysis) studies. On the other hand, macroscopic studies provide an excellent preliminary assessment tool and have proven to be of considerable value in petrographical studies (e.g. see Mandal 1997; Cooney and Mandal 1998).

Solid Geology and Soils of the Site (see Figure 1; McConnell 1994)
The bedrock under the site consists of crinoidal wackestone/ packstone limestone belonging to the Ballyadams Formation (shown on Figure 1 as BM).

The stratigraphical sequence in the area consists of the following. Gaps in the stratigraphically sequence are represented by line breaks.

Carboniferous (Silesian)
Coolbaun Formation (CQ) – Shale and mudstone with this coals
Moyadd Coal Formation (MC) – Shale, siltstone and minor sandstone
Bregaun Flagstone Formation (BE) – Thick flaggy sandstone and siltstone
Killeshin Silstone Formation (KN) – Muddy siltstone and silty mudstone
Luggacurren Shale Formation (LS) – Mudstone and shale with chert and limestone

Carboniferous (Dinantian)
Clogrenan Formation (CL) – Cherty, muddy calcarenite limestone
Ballyadams Formation (BM) – Crinoidal wackestone/ packstone limestone
Milford Formation (MI) – Peloidal calcarenite limestone
Butlersgrove Formation (BU) – Very dark grey argillaceous limestones
Ballysteen Formation (BA) – Fossiliferous dark-grey muddy limestone
Ballymartin Formation (BT) – Limestone and dark grey calcareous shales
Quinagh Formation (QU) – Lenticular mudstone and coarse siltstone
Porter's Gate Formation (PG) – Sandstones, shales and thin limestones

Devonian
Kiltorean Formation (KT) – Yellow and red sandstones, green mudstones
Carrigmaclea Formation (CI) – Red, brown conglomerates and sandstones

Ordovician
Oaklands Formation (OA) – Green, red-purple, buff shale, siltstone
Maulin Formation (MN) – Dark blue-grey slate, phyllite, schist

Igneous Intrusions
The Tullow Pluton (Tw) – Fine to coarse granites dating to *c.* 405Ma

The geology of the area is generally dominated by Lower Carboniferous Age rocks, principally limestones. These rocks, which also make up much of the Midlands of Ireland, represent the northward return of the sea at the end of the Devonian, *c.* 360 million years ago, owing to the opening of a new ocean to the south called the Palaeo-Tethys in what is now central Europe.

To the south of the study area occur Ordovician-Devonian Age rocks. The Devonian Age rocks consist of coarse sandstone and conglomerates representing terrestrial sediments resulting from a period of tectonic uplift.

The older, Ordovician Age rocks represent tectonic activity, relating to the closure of the Iaepetus Ocean, a major ocean which at its widest was probably greater than 3000km across. These rocks have been metamorphosed to slates, phyllites and schists by the intrusion of the Tullow granite pluton *c.* 405 million years ago.

Bedrock is not exposed at surface at the site; instead the overburden consists of boulder clay; surface drift from early glaciations. The area is part of a physical region known as the Caledonian province of the south-east. The soils of the area consist of acid brown earths (Aalen et al. 1997).

Results

Site	Ministerial Direction		NMS Reg.	Sample	Context	Notes		
Jordanstown 3	A032/152	AR122	E3916	1	11	Burnt;	Rounded to sub-angular; includes pebbles;	Sandstone, very coarse grained, quartz rich, red/yellow
Jordanstown 3	A032/152	AR122	E3916	6	27	Burnt;	Rounded to sub-angular; includes pebbles;	Sandstone, very coarse grained, quartz rich, red/yellow

Potential Sources

Coarse grained sandstone does not occur in bedrock in the immediate vicinity of the site. The dominant rock type in the area is limestone. Whilst there are minor sandstones within some of the limestone formations, the closest bedrock source for coarse grained yellow / red sandstone is within the Devonian Age Kiltorean Formation (yellow and red sandstones, green mudstones) and Carrigmaclea Formation (red, brown conglomerates and sandstones) (see Figure 1, shown as KT and CI respectively). It is important to note that these rock types were not necessarily sourced from bedrock. The sample is clearly a shattered cobble, indicating a secondary source, such as in the glacial tills / river cobbles. It is therefore possible that these rocks were sourced locally.

Discussion

Whilst it is not possible to determine a definitive source for these stone samples based on macroscopic examination alone, it can be stated that these rock types are available locally in outcrop and within the glacial tills / sub-soils. It is therefore probable that the material in these samples were sourced in the vicinity of the site.

A total of 159 samples were examined from the scheme across 33 sites (see Table 2). The samples showed a remarkable consistency across the scheme in terms of the principal rock type utilised; very coarse to medium grained sandstone, typically red to yellow in colour. All samples contain a variation of this type of rock as their principal component. Just under half (73) of the samples are clearly burnt / altered, but this does not rule out the possibility that the stone from other samples had been burnt. All bar one (a sample from Kellymount 5 (E3858:43:156)) contained angular pieces of stone, and 122 (77%) also contained sub-rounded to rounded pieces. A total of 63 of the samples contained pebbles and / or cobbles, in most cases broken. Five of the samples contained minor amounts of limestone as a secondary rock type to sandstone.

Site	Licence			No.	Burnt	Angular	Rounded	Pebbles	Limestone
Kilree 1	A032/107	AR091	E3728	1	0	1	0	0	0
Dunbell Big 2	A032/130	AR095	E3853	1	1	1	1	0	0
Holdenstown 4	A032/101	AR100	E3682	7	7	7	7	0	0
Rathcash 1	A032/133	AR102	E3859	3	0	3	3	3	0
Rathcash 2	A032/134	AR103	E3860	12	12	12	12	12	0
Rathcash East 2	A032/136	AR105	E3893	3	0	3	3	0	0
Blanchvillespark 3	A032/140	AR109	E3913	3	0	3	3	3	0
Blanchvillespark 4	A032/141	AR110	E3914	3	3	3	0	0	0
Ballyquirk 1	A032/143	AR112	E3863	1	1	1	1	0	0
Ballyquirk 2	A032/144	AR113	E3864	5	5	5	1	0	0
Ballinvally 1	A032/146	AR115	E3836	1	0	1	1	0	0
Garryduff 1	A032/147	AR116	E3852	4	0	4	0	0	0
Jordanstown 2	A032/151	AR120	E3851	4	4	4	0	0	0
Kellymount 6	A032/122	AR121	E3758	3	3	3	3	0	0
Jordanstown 3	A032/152	AR122	E3916	2	2	2	2	2	0
Kellymount 2	A032/111	AR124	E3757	11	4	11	11	9	1
Kellymount 3	A032/112	AR125	E3856	13	2	13	2	0	1
Kellymount 5	A032/114	AR127	E3858	27	10	26	24	21	3
Shankill 4	A032/153	AR130	E3838	5	1	5	4	0	0
Shankill 5	A032/154	AR131	E3850	2	1	2	1	0	0
Moanmore 1	A032/156	AR133	E3835	6	1	6	1	0	0
Moanmore 2	A032/157	AR134	E3843	2	0	2	2	0	0
Bannagagole 1	A032/159	AR136	E3844	3	2	3	3	3	0
Moanduff 1	A032/160	AR137	E3839	7	1	7	7	3	0
Coolnakisha 1	A032/128	AR139	E3768	1	0	1	1	1	0
Cranavonane 1	A032/164	AR141	E3842	2	2	2	2	2	0
Tomard Lower 1	A032/117	AR144	E3733	1	0	1	1	1	0
Paulstown 1	A032/093	AR145	E3642	3	1	3	3	2	0
Rathgarvan or Clifden 1	A032/125	AR147	E3760	1	0	1	1	0	0
Maddockstown 1	A032/126	AR148	E3759	3	3	3	3	0	0
Leggetsrath East 1	A032/118	AR154	E3734	1	1	1	1	0	0
Moanduff 3	A032/120	AR156	E3736	1	0	1	1	1	0
Ballyquirk 4	A032/167	AR157	E3848	17	6	17	17	0	0
Grand Total :				**159**	**73**	**158**	**122**	**63**	**5**

Table 2. Results of petrographical analysis of stone samples from the N9/N10 Phase 4b Road Scheme

Coarse grained sandstone is typical of *fulacht fiadh* material (e.g. see Mandal 2004). The use of angular and rounded pieces is interesting. Rounded pieces and / or the use of pebbles / cobbles is clear evidence of the use of secondary sources. Angular pieces are more indicative of the use of bedrock sources, but it is important to note that they could also represent angular blocks occurring in tills.

It is significant that sandstone is the predominant rock type given that, due to the differing underlying bedrock, it would not be the most abundant rock type available, either in outcrop or in the overlying tills. This indicates that sandstones were deliberately being selected for use in preference to the more abundant finer grained rock types in the area.

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Appendix 2.5 Radiocarbon Dates – 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 ‰
C11 (fill of pit C8)	1	Burnt deposit	Fraxinus Excelsior / 0.05g	QUB	UBA 13119	AMS (Std)	2341–2209BC (1 Sigma) 2457–2202BC (2 Sigma)	3838±25	-29.9
C27 (fill of pit C9)	6	*Fulacht* material	Fraxinus Excelsior / 0.5g	QUB	UBA 13120	AMS (Std)	2293–2205BC (1 Sigma) 2401–2148BC (2 Sigma)	3820±25	-24.3

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
KK016–009001	Souterrain
KK016–009002	House 16/17th Century
KK021–001001	Church
KK021–001002	Graveyard
KK021–001003	Ecclesiastical Enclosure
KK021–002001	Enclosure
KK021–002002	Enclosure
KK021–003	Enclosure
KK021–004	Enclosure

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

Site Name	*Site Code*	*E Number*	*Director*	*NGR*
Blanchvillespark 2	AR108	E3895	Tim Coughlan	260637/155449
Blanchvillespark 3	AR109	E3913	Tim Coughlan	260785/155653
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