Archaeological Impact Assessment
for Spaglen, Mallow, Co. Cork

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1 Introduction

1.1 Cork County Council are proposing to construct a residential development at Spaglen, Mallow, Co Cork (ITM 556640 599227) (Figs. 1 and 2). The proposed development site lies less than a kilometre northeast of Mallow town, Co. Cork. It comprises 3 irregular fields and adjoins Aldworth Heights to the north of St Josephs Road.

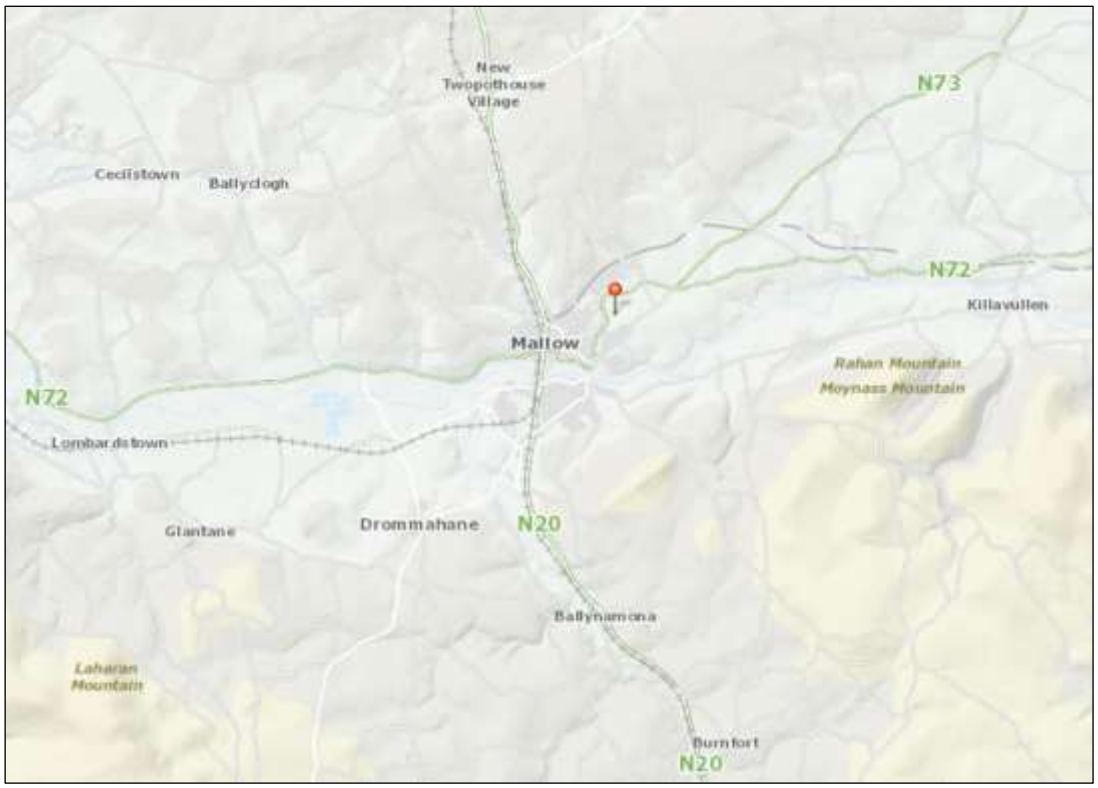


Figure 1: Ordnance Survey of Ireland location map

1.2 There are no recorded archaeological sites within the proposed development site. The closest recorded sites are two enclosures (CO033-089 and CO033-013) 115m and 373m to the east of the proposed development site. Both are located in the adjoining townland of Keatleysclose. A previously unrecorded monument was recorded during a geophysical survey and is located in the NW corner of the proposed development site (Murphy 2023).

1.3 There are no buildings or structures listed in the Record of Protected Structures (RPS) in the Cork County Development Plan (CCDP) 2022-2028. Likewise there are no buildings or gardens included in the National Inventory of Architectural Heritage (NIAH) within the proposed development site.

1.4 As part of this proposed development a geophysical survey was carried out in April 2023 under licence number 23R0127 (*Ibid*). This comprised a high-resolution magnetic gradiometer survey which was conducted on two of the three fields within the landholding. Several anomalies of archaeological potential were identified, the most notable of which was a portion of a curvilinear feature in the NW corner of the proposed development site. Murphy (*ibid.*) suggested that this might represent part of an enclosure ditch. The report is summarised in section 3 below and the full geophysical report is included as Appendix 1.

1.5 This report assesses the archaeological potential of the proposed development site by means of a geophysical survey, desktop assessment and field walkover survey. As part of the application, consultation was undertaken with Cork County Archaeologist, Annette Quinn, her recommendations are reflected in the report. The report was compiled by Máiréad Ní Challanáin and Avril Purcell, Lane Purcell Archaeology, 64 Fr Mathew Road, Turner's Cross, Cork on behalf of Walsh Design Group, The Mall, Maryborough Woods, Douglas, Cork.

Figure 2: Proposed development site on OS digital globe (2011-2013) www.archaeology.ie

2 Archaeological and Historic Background

2.1 The site is located in the townland of Spaglen in the parish of Mallow and barony of Fermoy, less than a kilometre northeast of Mallow town. There are no recorded archaeological monuments within the proposed development site. The closest recorded archaeological monuments are two enclosures in the adjoining townland of Keatleysclose (CO033-013 and 089) located 115m (CO033-089) and 373m (CO033-013) to the east. Both are listed in the Record of Monuments and Places (RMP) for Co. Cork and the Sites and Monuments Record (SMR) database of the Archaeological Survey of Ireland (ASI). The RMP lists all archaeological monuments and places known to be of archaeological importance in the county and affords them statutory protection under the National Monuments Act 1930 to 2004 (1994 amendment). The SMR database is a working database of all known archaeological monuments in the state and is continually updated. Both enclosures mentioned above are described in the Archaeological Inventory of Co. Cork (Power *et al*. 1994) as follows:
CO033-013 '*Cropmark of fosse of circular enclosure (diam. c. 30m) visible in aerial photograph (GSIAP, W413, July 1975; CUCAP, BDS11, July 1970); concentric outer fosse NNW->S; field fence shown on 1905 and 1935 OS 6-inch maps kinks either to skirt or follow the line of the outer fosse from S->NNW. Aerial photograph (CASAP, July 1989) shows field fence levelled and E half of site now within sports field. The kink of the field fence suggests some upstanding remains of enclosure when fence was built post 1842'*.

CO033-089 '*Cropmark of two concentric fosses of circular enclosure (diam. c. 30m) visible in aerial photograph (CASAP, July 1989). Field fence crosses centre of enclosure on N-S axis'.*
The two enclosures, like many others in the area are likely to be levelled or partially levelled ringforts, however, further archaeological investigation would be required to confirm this.

2.2 There are 31 recorded archaeological sites within an approximate 1km radius of the proposed development site (Fig. 3). These date from the Bronze Age (2400-500BC), early medieval (5th – 12th century AD) and the post-medieval period (1550-1750), with the majority dating to the post-medieval period (Table 1).

SMR/RMP No.	Site Type	Townland	Distance from site
CO033-005	Lime kiln	Mallow	663m to W
CO033-006001-	Graveyard	Mallow	944m to SW
CO033-006002-	Church	Mallow	944m to SW
CO033-006003-	Market house	Mallow	905m to SW
CO033-007001-	Lime kiln	Castlelands	607m to SW
CO033-007002-	Spa works/bath	Spaglen	609m to SW
CO033-007003-	Holy well	Spaglen	553m to SW
CO033-007004-	Holy well	Spaglen	609m to SW
CO033-008	Church	Mallow	924m to SW
CO033-009001-	Fortified house	Castlelands	965m to SW
CO033-009002-	Country house	Castlelands	889m to SW
CO033-009003-	Ice house	Castlelands	747m to SW
CO033-009004-	Tower house	Castlelands	998m to SSW
CO033-009005-	Hospital	Castlelands	829m to SW
CO033-009006-	Bawn	Castlelands	998m to SSW
CO033-010	Ringfort	Castlelands	865m to S
CO033-011001-	Ringfort	Castlelands	831m to S
CO033-011002-	Redundant record	Castlelands	831m to S
CO33-012	Ringfort	Castlelands	536m to SE
CO033-013	Enclosure	Keatleysclose	373m to E

CO033-014	Enclosure	Parkadallane	600m to E
CO033-088	Lime kiln	Castlelands	963m to S
CO033-089	Enclosure	Keatleysclose	115m to E
CO033-090	Fulacht fia	Castlelands	424m to SE
CO033-091	Fulacht fia	Castlelands	497m to S
CO033-092	Designed landscape feature	Castlelands	920m to SSW
CO033-093	Historic town	Mallow	942m to SW
CO033-126	Standing stone	Mallow	472m to W
CO033-129	Railway bridge	Leaselands/Spaglen	704m to NW
CO033-139	Industrial site	Ballyviniter Lower	800m to N
CO033-140	Excavation/miscellaneous	Castlelands	835m to S

Table 1: RMP/SMR sites within a 1km radius of the proposed development site

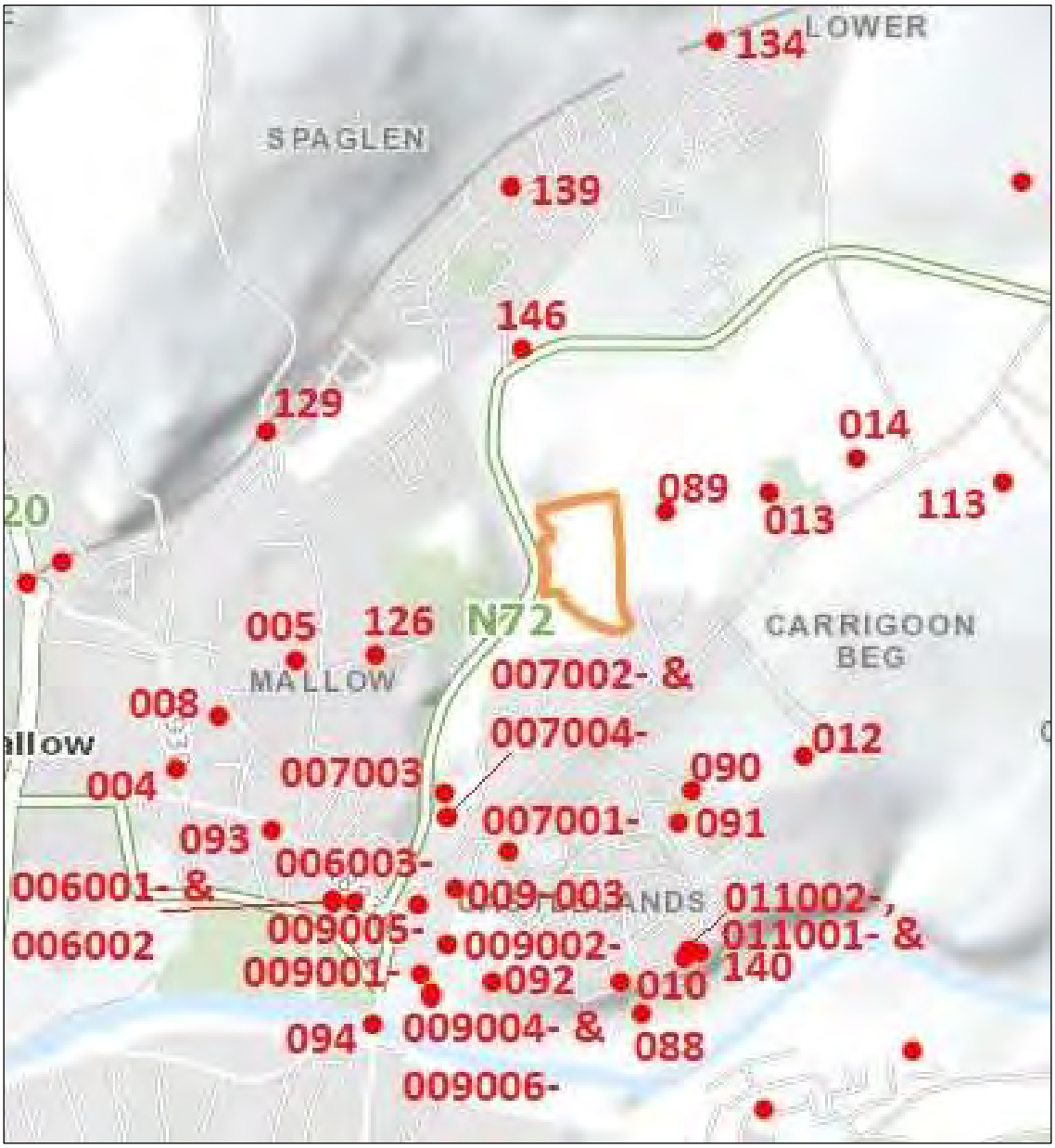


Figure 3: Proposed development site outlined in red showing archaeological monuments within a 1km radius (www.archaeology.ie)

2.3 Four of the recorded archaeological monuments within the 1km radius are prehistoric in date. There are two fulachtaí fia (CO033-090 and 091) in Castlelands, a standing stone (CO033-126) in Mallow and a Neolithic/Bronze Age pit (CO033-140) also in Castlelands. Fulachtaí fia are generally interpreted as ancient cooking sites, but could have been used for any purpose that required large quantities of hot or boiling water. They usually survive as a spread, or mound, of heat-shattered and burnt stone. The burnt stone generally fills and covers one or more troughs or pits cut into the ground. The trough, which was sometimes lined with timber, wattle or stone, was generally excavated below the water table, near a spring or stream and allowed to fill with water. A fire was set adjacent to the trough, to heat stones, and the water was then heated or boiled by immersing the fire-heated stones in it. Experiments have shown that large quantities of water can be boiled in this way in about twenty minutes and joints of meat wrapped in straw can be cooked over several hours. After each use the burnt and heat-shattered stones would have to be cleaned out of the trough. Over time this material accumulated to form a crescent shaped mound of burnt material around the trough. Fulachtaí fia are usually dated to the Bronze Age (2400-500BC), although a minority of excavated examples have been dated to the early historic periods. Although they are generally interpreted as cooking sites they were also used for bathing, processing textiles, tanning, brewing, extraction of fats from meat, and soap making, or even a combination of these functions (Ó Drisceoil, 1988; Monk 2007; Quinn & Moore 2007).

The two fulachtaí fia in Castlelands (CO033-090 and CO033-091) were investigated in 2004. Their extent was established and they were retained *in situ* within buffer zones in a residential development (Purcell 2004).

Standing stones may have had a number of functions in the prehistoric landscape. They were often erected in prominent locations and may have marked routeways or tribal boundaries but others may have marked burials or had a ceremonial or ritual purpose. More recent examples may have been erected as scratching posts for animals. The example in Mallow (CO033-126) is described as being square in plan with no obvious alignment recorded. It was removed in 2003 for repair after being damaged during nearby development work (Ronan *et al* 2009).

The pit feature (CO033-140) in Castlelands was identified during archaeological monitoring in advance of a housing development and was subsequently excavated. Three sherds of pottery found in the pit dating to the Neolithic/ Bronze Age indicated the pit was of a prehistoric date (Lane, 2002).

2.4 There are a number of recorded monuments dating to the early medieval period within the 1km radius of the proposed development site. These include the ringforts in Castlelands (CO033-010, CO033-011001- and CO033-012) and presumably the enclosures in Keatleysclose (CO033-013 and CO033-089) and Parkadallane (CO033-014). The holy wells in Spaglen (CO033-007003- and CO033-007004-) may also date to the early medieval period although one of the wells (CO033-007004-) was used as spa well from the 18th century. The early medieval period is characterised by the introduction of Christianity from the late 4th century onwards, becoming widely established during the second half of the sixth century. Ringforts (also known by the names rath, lios, cathair or caiseal/cashel) are defended farmsteads and are the most characteristic monument of this period. Their main phase of construction and occupation dates from the beginning of the 7th century AD to the end of the 9th century. They are generally circular or oval in plan, defined by an earthen bank with an external ditch or fosse. Larger ringforts with double defences (bi-vallate) and triple defences (tri-vallate) are generally interpreted as higher status sites and these can be particularly associated with specialised craft working. The sub-surface remains of circular dwelling houses and associated outbuildings are frequently revealed within ringforts during excavation. Some ringforts have associated souterrains (underground chambers connected by narrow creepways) as defensive features which may have also been used for storage. Others have associated corn-drying kilns and sometimes external structures. Generally, it has been speculated that the elite of society occupied ringforts and that the less wealthy lived in undefended settlements scattered across the landscape. In more recent archaeological investigations, particularly on road infrastructure projects in Co. Cork, the number and type of unenclosed medieval settlements identified has been growing, suggesting more diversity in contemporary settlement patterns (Monk, 2019) and challenging the perceived importance of ringforts within the early medieval landscape.

Archaeological investigations were undertaken in the vicinity of the three ringforts in Castlelands (Purcell 2000 and 2004). Archaeological deposits were identified in the vicinity of the levelled ringfort (CO033-011001-) which were preserved *in situ* (Purcell 2000). No deposits were identified in the vicinity of the other two (CO033-010 and CO033-012).

Enclosures are monuments which are generally levelled with no above ground remains surviving; many are recorded as cropmarks on aerial photographs and the three within the study area were identified in this way (Power and Lane, 2000). The three presented as circular or oval cropmarks suggesting they represent the remains of levelled ringforts.

The tradition of visiting holy wells goes back to the very beginnings of Irish Christianity, but most wells probably have their origin in pre-Christian ritual activities. The majority of the 'wells' are springs or just depressions in rocks where rainwater collects; some have more recently constructed stone or concrete surrounds (Logan, 1992, 171). Some wells are still maintained for holy use when at certain times of the year they are visited in the form of a pilgrimage often referred to as a 'round' or 'pattern'. Other wells are known through tradition for their reputed curative properties. Logan (*ibid.*, 116) notes the long tradition of visiting holy wells down through the centuries and lists many of the customs, such as votive offerings, associated with these sites. Offerings are an essential part of the pilgrimage and can consist of money, stones, pieces of cloth, buttons, brooches and other everyday items. Sometimes these may be left at the side of the well, tied to a nearby tree or thrown into the well itself. Holy wells are so abundant in Ireland that most parishes in the country have at least one such site, whether in use or not (*ibid.*). One of the holy wells at Spaglen (CO033-007004-) was dedicated to St Patrick although Lewis associates it with St Peter (Power and Lane 2000). It is noted that it is no longer in holy use.

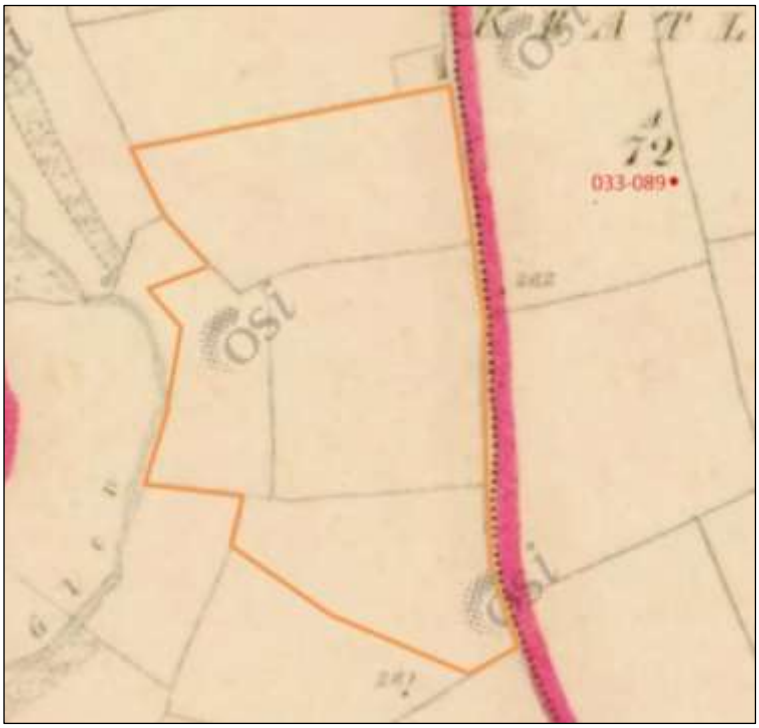
2.5 The proposed development site lies on the northeastern outskirts of the historic town of Mallow (CO033-093). The historic town lies on the north side of the River Blackwater and has medieval origins which probably date to the late 12th century when the Anglo-Normans reputedly built a castle here (Power and Lane, 2000, 596). This settlement may not have been very substantial as the town fell into decline during the later medieval period. It remains uncertain whether the town was ever walled, although some evidence suggests it was defended (Thomas 1992, 231). The town was re-established during the plantation of Munster with numbers of settlers growing steadily. In 1611 there were twenty-five settlers in Mallow and by 1641 there were nearly 200 houses. In 1642 the town was attacked by the Irish and partially burnt, however, it survived and during the eighteenth and nineteenth centuries it grew and prospered as a market and spa town (Power and Lane, *ibid.*). Lewis (1837) describes the town as *…'a market town…containing 9804 inhabitants…the town…formed part of the territories of the great Earl of Desmond…The town is finely situated on the northern bank of the river Blackwater, about a mile below its confluence with the Clydagh…chiefly of one main street on the mail coach road from Cork to Limerick, near one extremity of which was Castle Garr, on the site of which is now a modern house; and at the other is Mallow Castle, commanding the river, over which is a stone bridge of eleven arches…'*

The remains of a tower house and bawn (CO033-009004- and CO033-009006-) lie in Castlelands on the north bank of the River Blackwater. The tower house may have been built on the remains of an earlier castle. A fortified house (CO033-009001-) lies nearby overlooking the bridge on the Blackwater. The house was built by Sir Thomas Norris who was granted the Manor of Mallow during the Munster plantation. Norris died in 1599 and the house was ruined by the Confederate forces in 1645 and burnt down in 1689 (*ibid.)*.

Other recorded archaeological sites within a 1km radius of the proposed development site include a lime kiln in Mallow (CO033-005) to the west, two in Castlelands (CO033-088, CO033-007001-) to the south and southwest, two churches (CO033-006002-, CO033-008), a graveyard (CO033-006001-), a hospital (CO033-009005-) and market house (CO033-006003-) in Mallow to the southwest and a spa/bath (CO033-007002-) in Spaglen. A country house (CO033-009002-), ice house (CO033-009003-) and a designed landscape feature (CO033-092) show the continued use of the demesne into the 18th-20th centuries. These sites reflect the

various religious, secular and industrial aspects of the lives of the inhabitants in the area since it's foundation in the 12th century and its development as a plantation town.

2.6 No archaeological work has been undertaken in the area proposed for development. Just one archaeological investigation is recorded in the excavations bulletin (www.excavations.ie) for the townland of Spaglen. A large number of archaeological excavation have been undertaken in Mallow town. Material dating to the 17th century was identified in Bridge Street in the town during archaeological monitoring, the material was preserved *in situ* (Lane 1997), otherwise archaeological material has not been identified during archaeological investigations in the town (www.excavations.ie). A large number of archaeological investigations have been undertaken in the adjoining townland of Castlelands, as outlined above, where large residential developments were undertaken during the early 2000s.



2.7 The OS 6-inch map of 1842 (Fig. 4) depicts the area of the proposed development site as two complete fields and parts of two others, bordered on the east side by the townland boundary with Keatleysclose, and on the west by the Spa Glen spring and open fields. There are also open fields to the south and north. There is a small unnamed rectangular structure directly outside the northeastern corner. There are no features or structures depicted within the area.

Figure 4: Extract from OS 6-inch map (1842), with proposed development site outlined in orange (www.archaeology.ie)

The field layout remains unchanged on the 25-inch OS map (1897-1903), (Fig. 5). The unnamed structure outside the northeastern corner is no longer depicted. The site remains unchanged again on the 1933 6-inch OS map.

Figure 5: Extract from OS 25-inch map (1903), with proposed development site outlined in orange www.archaeology.ie

Aerial photographs by the Ordnance Survey of Ireland (OSI) from 2005 (Fig. 6) and 2011-13 (Fig. 2) show the area of the proposed development site largely in its current configuration; two fields and rough overgrown ground at the western end. Circular patterns in the vegetation growth in the two fields relates to grazing patterns of animals tethered to a peg/post.

Figure 6: Aerial photograph from *circa* 2005 (after OSI) with development site in red outline

3 Geophysical Survey

3.1 A pre-planning geophysical survey was carried out on the proposed development site in April 2023 under licence number 23R0127 (Murphy 2023). The survey, comprising a detailed gradiometer survey, was conducted on two of the three fields within the landownership boundary, the third was unsuitable for survey due to its overgrown condition. The accompanying drawing is mislabelled with Field 3 annotated as Field 1 and Field 1 is unlabelled. The survey was conducted with a sampling interval of 0.25m and a traverse interval of 1m for all the survey areas. Several anomalies were identified during the survey and are listed below (Fig. 7 and Table 2) (*ibid*).

Form/Nature of Anomaly	Possible Source(s) of Anomaly	Description
Archaeology	Enclosure Ditch	Portion of a curvilinear linear feature, might represent a portion of an enclosure ditch. Anomaly is located in the northwest portion of Field 1. A number of anomalies (Archaeology) that might represent features of archaeologial significance were recorded within.
Archaeology	Pits, postholes, cut features, large pits spreads	Positive responses, due to their location might be of archaeological potential. These could represent pits, postholes, cut features such as kilns, large pits and spreads associated with ditch/possible enclosure.
Trend	Curvilinar trend/poss. bank	Curvilinear trend in the northwest portion of Field 1. Might represent a bank associated with curvilinear ditch/possible enclosure.
Trends	Linear, curvilinear and oval trends	Linear, curvilinear and oval trends. These appear to be concentrated in the northwest portion of the site, hence their archaeologial potential can not be excluded. Curvilinear and oval trends might represent remains of ring ditches due to their size; ephemeral in nature suggesting geological origin, these could be also the results of recent land use.
?Archaeology	Pits, postholes, cut features, large pits spreads or natural geology/iron in topsoil	An array of positive responses of potential archaeological significance. These include small anomalies that might represent cut features such as pits/postholes, while large anomalies might represent large pits or spreads. These could alternatively represent modern iron objects within the topsoil or natural underlying geological features.
Linears	Linears, former field boundaries/drains	Linear anomalies in Field 2, north to south and east to west aligned representing former field boundaries or drains. These might be removed field boundaries or drains that manifest as linear anomalies. These do not correspond with any Ordnance Survye map boundaries.
Cultivation	Cultivation furrows/agricultural furrows	A series of parallel, east to west aligned linears, interpreted as cultivation furrows.
Modern anomaly/Magnetic interference	Recent ground works/made up ground and reinstatement	Areas of magnetic disturbance/modern interference associated with recent land use. Areas of soil tipping apparent from examination of aerial imagery.

Table 2: Results of geophysical survey

3.2 The anomalies identified in the northwest corner of Field 1were interpreted by Murphy (*ibid.*) as a part of a possible enclosure with possible internal cut features, such as pits, postholes and large cut features and spreads. A trend outside the possible enclosure was interpreted as a possible associated bank. Other positive responses on the northern side of the field were interpreted as possible archaeological features such as pits, postholes or other cut features and spreads although they may represent ferrous material in the topsoil or underlying geological features. The remaining anomalies were thought to represent evidence of previous land use including drains and furrows. Areas of magnetic interference were considered to represent recent disturbance.

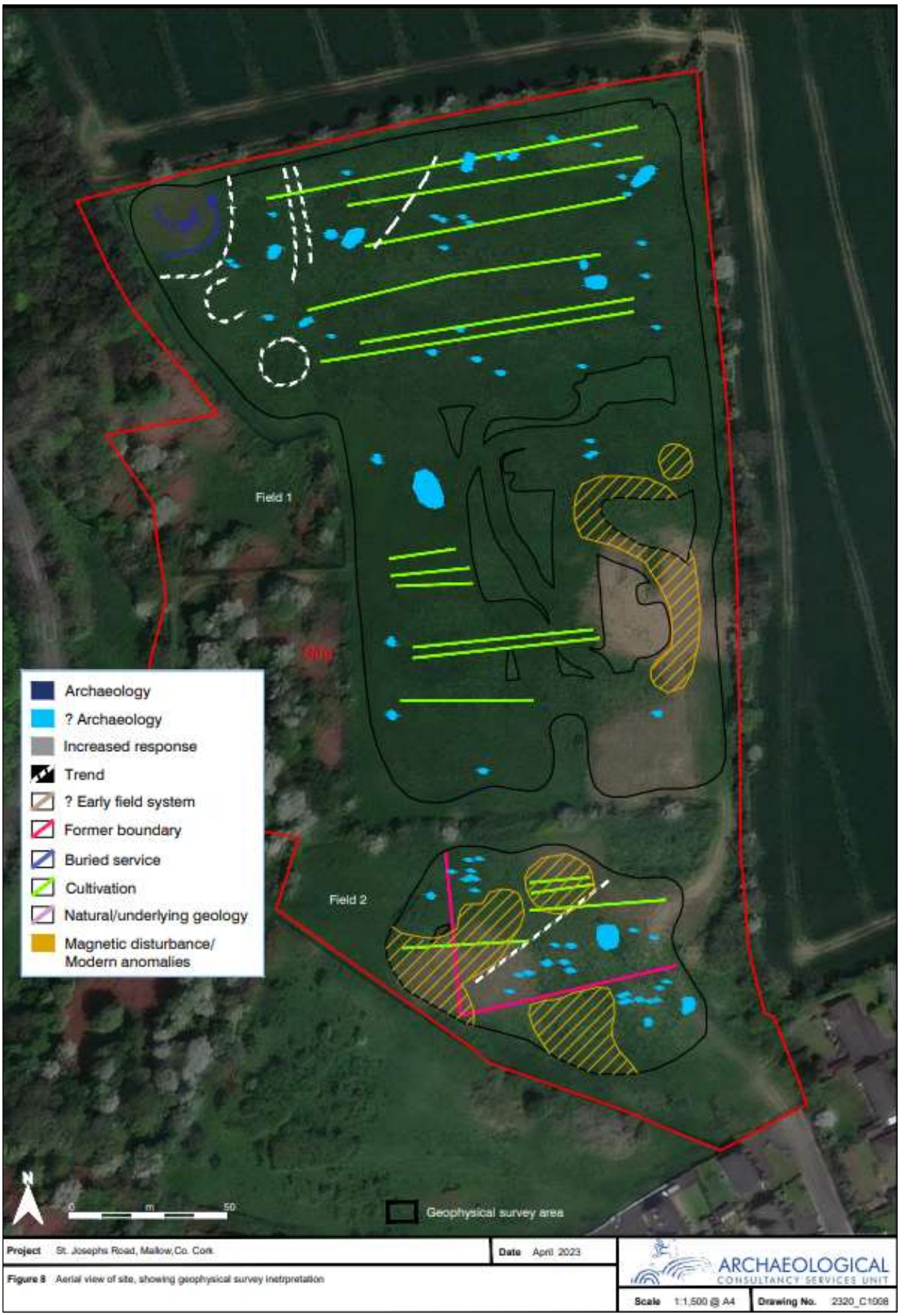


Figure 7: Anomalies identified in geophysical survey (Murphy 2023)

4 Field Inspection and Survey

4.1 The field inspection comprised a walk over and it was undertaken on the 14th June 2023 in dry, hot weather conditions. The proposed development site was accessed through Aldworth Heights, St Josephs Road. It comprises three adjoining fields, two (Fields 1 and 2)in rough pasture and one (Field 3) which is heavily overgrown and inaccessible (Fig. 6). Field walking was undertaken to assess ground conditions and determine whether previously unrecorded remains of archaeological and cultural heritage significance survive within the site. Current land use, local topography and environmental conditions are assessed to gain an overall picture of the area.

4.2 The proposed development site comprises undulating ground falling quite steeply to the north and more steeply to the west towards the N72 road. The majority of the land is under pasture which has not been grazed in some time and is quite rough in places. Field 3 and the western parts of Fields 1 and 2 are heavily overgrown with trees and scrub and are inaccessible.

Plate 1: Field 1, towards SE of centre looking NW

Plate 2: Field 1 from NW corner, looking SE

4.3 There are some areas of disturbance in both Fields 1 and 2. Isolated areas of ground have been stripped of topsoil in both fields; in Field 1 one such area is flanked by overgrown mounds, presumably of the topsoil. More recent disturbance is apparent presumably relating to site investigation works, this includes the removal of vegetation along an overgrown strip of ground at the west of Field 1, adjoining Field 3.

4.4 Dense hedgerows, in places combined with a substantial metal fence, define the proposed development site. Fields 1 and 2 are separated by an intermittent hedgerow while Field 3 is separated from the others by the metal fence.

Plate 3: Field 1 from SE corner, looking N

Plate 4: Area stripped of topsoil in Field 1 with mounds adjoining, looking SE

4.5 The NW corner of Field 1 is an elevated area of ground which rises gently to a small plateaux and this is where the possible portion of enclosure was identified in the geophysical survey. This area stands out prominently both on the proposed development site and in the local landscape, however, heavy overgrowth to the west and a dense hedgerow to the north currently limit visibility. In the absence of the vegetation this plateaux would probably afford extensive views to the north and west. Some ground disturbance in the area indicates that a trial pit may have been dug here. There was no surface evidence, however, to indicate the presence of this possible enclosure or for any of the other anomalies identified in the geophysical survey. No features or finds of archaeological significance were identified on the proposed development site.

Plate 5: Field 1 , looking to NW corner where possible enclosure was identified in geophysical survey

Plate 6: Field 2, looking SW

Plate 7: Field 2, looking NW

Plate 8: Field 2, looking SE

Plate 9: Field 3 inside fence, looking NW

6 Conclusion and Recommendations

6.1 The proposed development site is located in Spaglen townland less than a kilometre northeast of Mallow town, Co. Cork. It is accessed from St Josephs Road and lies to the east of the N72. It comprises 3 irregular fields.

6.2 Cork County Council are proposing to construct a residential development on the site with all associated ancillary services.

6.3 Following a desktop study, geophysical survey and site inspection, the following conclusions were made;

- There are no recorded archaeological monuments within the proposed development site. The closest recorded sites are two enclosures (CO033-089 and CO033-013) 115m and 373m to the east both in the adjoining townland of Keatleysclose. The two are likely to represent levelled ringforts. There are no protected structures listed in the CCDP (2022-2028) and no structures listed in the NIAH for County Cork within the proposed development site.

- The proposed development site comprises three irregular fields, two of which (Fields 1 and 2) are in rough pasture and have not been grazed for some time. The western ends of both fields are heavily overgrown and largely inaccessible. The third field (Field 3) is densely overgrown and separated from the others by a substantial metal fence. It is currently inaccessible. No features or finds of archaeological potential were noted during field walking.

- As part of this assessment, a geophysical survey was carried out under licence number 23R0127 (Murphy 2023). The survey, comprising a full detailed gradiometer survey, was conducted on two of the three fields within the proposed development site. Several features of archaeological potential were identified in the survey including part of a possible enclosure in the northwest corner of Field 1 with possible internal cut features and spreads. A trend outside the possible enclosure was interpreted as a possible associated bank. Other positive responses in the north of the field were interpreted as possible archaeological features such as pits, postholes or other cut features and spreads. Alternatively it was thought that they may represent ferrous material in the topsoil or underlying geological features. Other anomalies were interpreted as evidence of previous land use, including drains and furrows represented as linear anomalies. Recent disturbance was evident as areas of magnetic interference.

6.4 Impacts

There are no recorded archaeological sites listed in the RMP/SMR within the proposed development site. The proposed development will, therefore, not impact on any known recorded archaeological site.

There are no protected structures listed in the CCDP (2022-2028) and no structures listed in the NIAH for County Cork within the proposed development site. The proposed development will, therefore, not impact on any registered structures of architectural merit.

A number of features of archaeological potential were identified in the geophysical survey including part of a possible enclosure in the NW corner of the proposed development site. The proposed development will involve large scale topsoil stripping and ground reduction. This would have a significant effect on the potential archaeological features identified in the geophysics. Where extensive earthmoving is involved there is always the possibility that archaeological material will be uncovered.

6.5 Mitigation

Archaeological testing across the site and of the anomalies of archaeological potential detected in the geophysical survey will be carried out in advance of development. The test trenching will be agreed with the

Cork County Archaeologist in advance. In the event that the testing verifies that the possible enclosure identified in the geophysical survey is of archaeological significance then preservation *in situ* will be required. If other features or finds of archaeological significance are revealed, the National Monuments Service (NMS) and the Planning Authority will be consulted as outlined in Framework and Principles for the Protection of the Archaeological Heritage (1999). All newly identified archaeological sites will be preserved *in situ* or by record and sufficient time and resources will be allowed to resolve all archaeological matters. Preservation *in situ* will require the relocation of any element of the development which may impact on any area of archaeological sensitivity. Preservation by record will require the excavation of the archaeological material and such material will be fully resolved to professional standards of archaeological practice (Policy Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands). This work will be funded by the developer.

6.6 All recommendations are subject to approval by the planning authority and the NMS.

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Appendix 1

Archaeological Testing

Spaglen, Mallow, Co. Cork

Licence Number 23E0624

Avril Purcell MA MIAI

November 2023

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Job Ref. LPA1201

on behalf of
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Abstract

The proposed development site is located at Spaglen Mallow, Co Cork and extends across two pasture fields. It is proposed to construct a residential development on the site.

There are no recorded archaeological monuments within the proposed development site. The closest recorded site is an enclosure (CO033-089) 115m to the east in the adjoining townland of Keatleysclose

A geophysical survey (Murphy 2023) was carried out on the site as part of a pre-planning archaeological assessment (Ní Challanáin and Purcell 2023). The survey identified a previously unrecorded circular enclosure in the NW corner of the proposed development site along with several other potential archaeological features possibly representing pits, postholes, cut features, spreads or natural geology. Numerous trends (curvilinear, linear and oval) were also identified, one of which was thought to be associated with the circular enclosure, while others were described as possibly representing remains of ring ditches, underlying geology or recent land use.

Archaeological testing of the proposed development site was carried out which included the excavation of twenty trenches across the site. The presence of the circular enclosure in the NW corner was confirmed as well as a smaller circular enclosure identified as a circular trend in the geophysical survey. Three large pits were also identified, two at the NW and one over 200m to the south.

It is proposed to preserve the circular enclosure and the circular trend *in situ* as well as a number of the isolated features in the NW corner of the proposed development site. It is proposed to preserve the large pit to the south by record through archaeological excavation in advance of development. Archaeological monitoring of topsoil stripping is recommended if development proceeds.

All recommendations are subject to approval by the National Monuments Service and the planning authority.

1 Introduction

1.1 Cork County Council are proposing to construct a residential development at Spaglen, Mallow, Co Cork (ITM 556640 599227) (Figs. 1 and 2). The proposed development site lies less than 1 kilometre northeast of Mallow town, Co. Cork. It comprises two irregular pasture fields (1 and 2) and adjoins Aldworth Heights to the north of St Josephs Road.

Figure 1: Ordnance Survey of Ireland location map

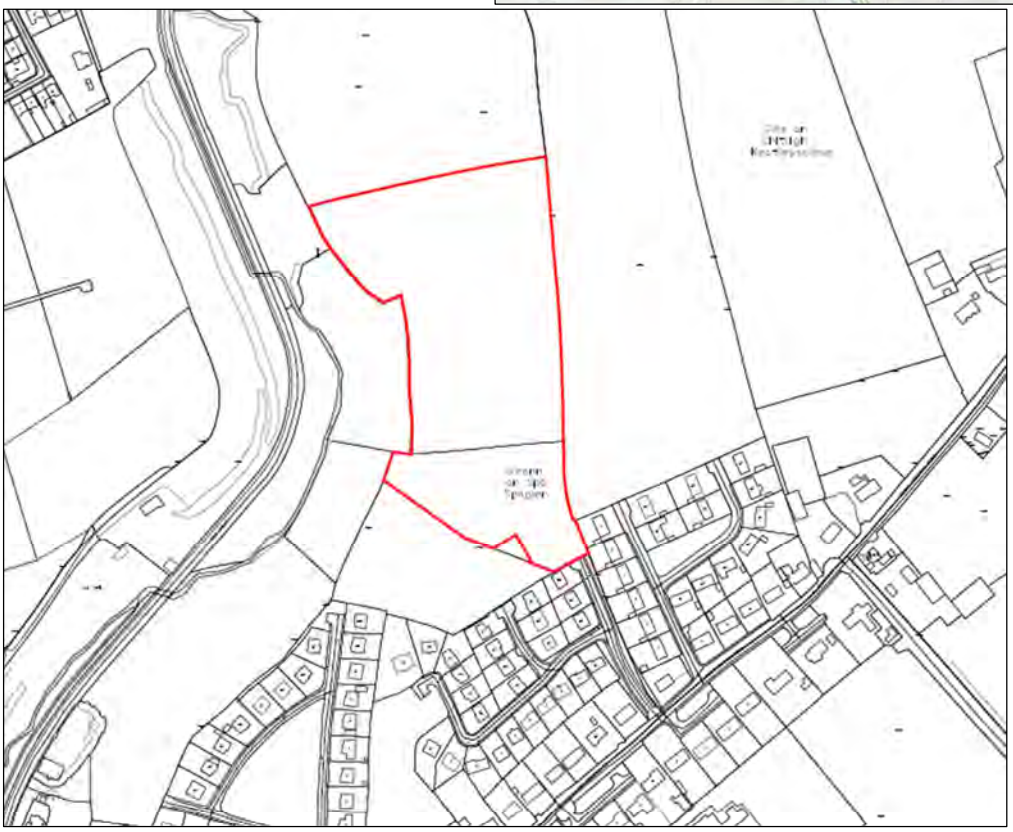

Figure 2: Extract from Ordnance Survey 1:2500 map showing development site

1.2 There are no recorded archaeological monuments within the proposed development site. The closest recorded site is an enclosure (CO033-089) 115m to the east in the adjoining townland of Keatleysclose (Fig. 3).

1.3 An archaeological assessment of the proposed development site and an adjoining field to the west was carried out in June 2023 (Ní Challanáin and Purcell 2023) and included a geophysical survey carried out in April 2023 (Murphy 2023). The geophysical survey identified a previously unrecorded circular enclosure in the NW corner of the proposed development site along with several other potential archaeological features which were described as positive responses possibly representing pits, postholes, cut features, spreads or natural geology (Fig. 4). Numerous trends (curvilinear, linear and oval) were also identified, one of which was thought to be associated with the circular enclosure, while others were described as possibly representing remains of ring ditches, underlying geology or recent land use (*ibid*.). The anomalies were not numbered

within the geophysical survey report. For clarity numbers were assigned to them within this report (Anomalies 1-4) (Fig. 4) as follows:

- Anomaly 1 – Circular enclosure, internal features (denoted in purple) and surrounding curvilinear trend curving clockwise from north to west (denoted as dashed white line) in NW corner of Field 1
- Anomaly 2 – Curvilinear trend, possible ring ditch, (denoted as dashed white circle) south of Anomaly 1 in NW corner of Field 1
- Anomaly 3 – Positive responses possible pits, postholes, cut features, large pits and spreads (denoted in blue) extending across Field 1
- Anomaly 4 – Positive responses possible pits, postholes, cut features, large pits and spreads (denoted as blue) extending across Field 2

1.5 Archaeological testing of the proposed development site was requested by Cork County Archaeologist, Annette Quinn. Testing was carried out under licence 23E0624 over three days in October 2023. Twenty trenches were excavated across Fields 1 and 2. The presence of the circular enclosure in the NW corner of the proposed development site was confirmed and a number of other probable archaeological features were also identified, the majority of which were noted in the geophysical survey. All of the features were concentrated in the NW corner of the proposed development site with one (F13) outlying to the south in Field 2. Significant re-design of the proposed residential scheme was carried out to accommodate the preservation *in situ* of the archaeological features in the NW corner of Field 1 and it is proposed to preserve by record, through archaeological excavation, the outlying feature (F13) to the south.

1.6 This report was compiled by Avril Purcell, Lane Purcell Archaeology, 64 Fr Mathew Road, Turner's Cross, Cork on behalf of Walsh Design Group, The Mall, Maryborough Woods, Douglas, Cork.

Figure 3: Aerial photograph (2013-2018 MapGenie) www.archaeology.ie

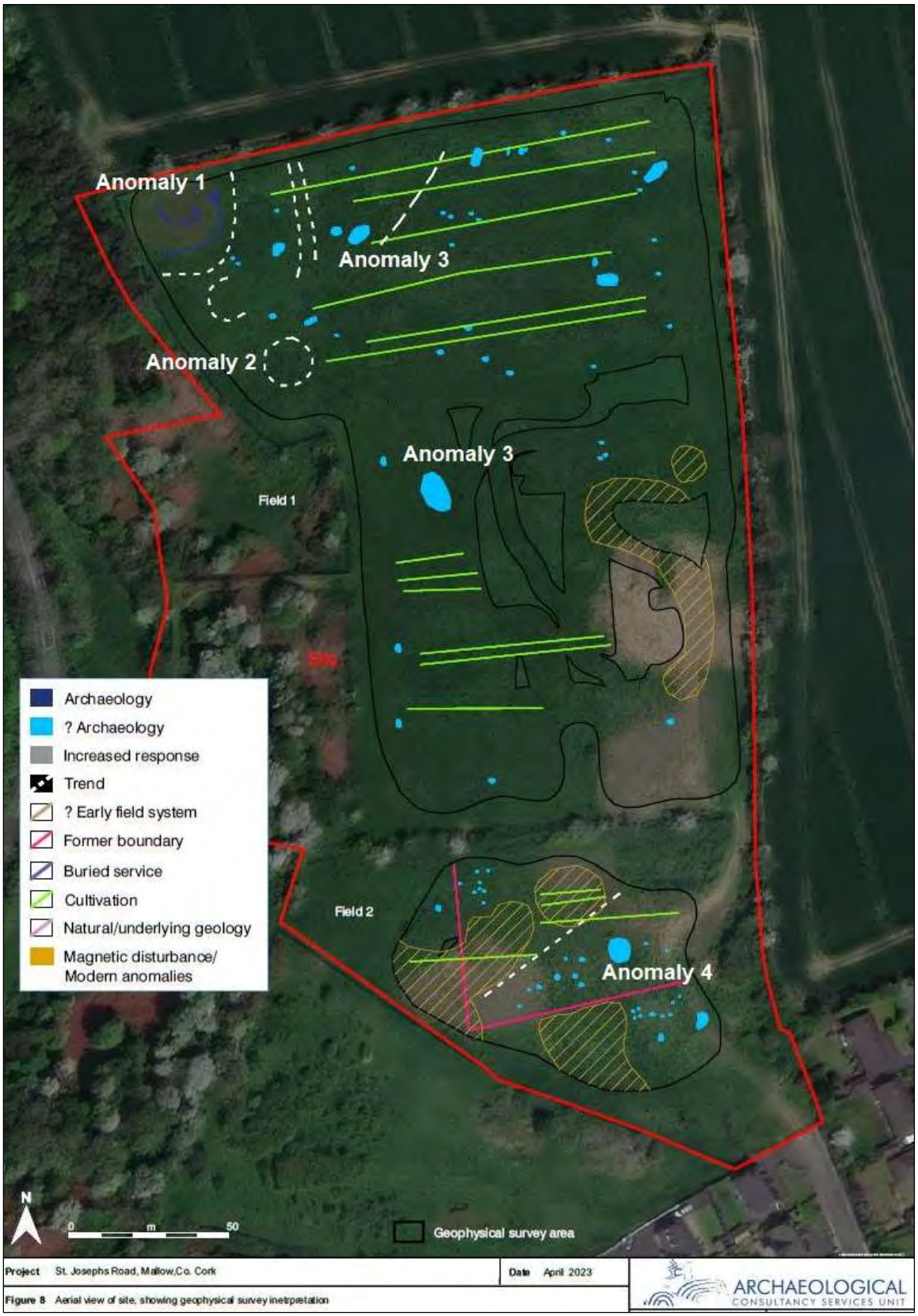

Figure 4: Interpretation of results of the geophysical survey (Field 3 is mislabelled Field 1 and Field 1 is unlabelled north of Field 2) (Murphy 2023). Anomalies 1-4 as labelled in this report.

2 Archaeological and Historic Background

2.1 The site is located in the townland of Spaglen in the parish of Mallow and barony of Fermoy, less than a kilometre northeast of Mallow town. There are no recorded archaeological monuments within the proposed development site. The closest recorded archaeological monuments are two enclosures in the adjoining townland of Keatleysclose (CO033-013 and 089) located 115m (CO033-089) and 373m (CO033-013) to the east. Both are listed in the Record of Monuments and Places (RMP) for Co. Cork and the Sites and Monuments Record (SMR) database of the Archaeological Survey of Ireland (ASI). The RMP lists all archaeological monuments and places known to be of archaeological importance in the county and affords them statutory protection under the National Monuments Act 1930 to 2004 (1994 amendment). The SMR database is a working database of all known archaeological monuments in the state and is continually updated. Both enclosures mentioned above are described in the Archaeological Inventory of Co. Cork (Power *et al*. 1994) as follows:
CO033-013 '*Cropmark of fosse of circular enclosure (diam. c. 30m) visible in aerial photograph (GSIAP, W413, July 1975; CUCAP, BDS11, July 1970); concentric outer fosse NNW->S; field fence shown on 1905 and 1935 OS 6-inch maps kinks either to skirt or follow the line of the outer fosse from S->NNW. Aerial photograph (CASAP, July 1989) shows field fence levelled and E half of site now within sports field. The kink of the field fence suggests some upstanding remains of enclosure when fence was built post 1842*'.

CO033-089 '*Cropmark of two concentric fosses of circular enclosure (diam. c. 30m) visible in aerial photograph (CASAP, July 1989). Field fence crosses centre of enclosure on N-S axis'.*
The two enclosures, like many others in the area are likely to be levelled or partially levelled ringforts, however, further archaeological investigation would be required to confirm this.

2.2 There are 31 recorded archaeological sites within an approximate 1km radius of the proposed development site (Fig. 3). These date from the Bronze Age (2400-500BC), early medieval (5th – 12th century AD) and the post-medieval period (1550-1750), with the majority dating to the post-medieval period (Table 1).

SMR/RMP No.	Site Type	Townland	Distance from site
CO033-005	Lime kiln	Mallow	663m to W
CO033-006001-	Graveyard	Mallow	944m to SW
CO033-006002-	Church	Mallow	944m to SW
CO033-006003-	Market house	Mallow	905m to SW
CO033-007001-	Lime kiln	Castlelands	607m to SW
CO033-007002-	Spa works/bath	Spaglen	609m to SW
CO033-007003-	Holy well	Spaglen	553m to SW
CO033-007004-	Holy well	Spaglen	609m to SW
CO033-008	Church	Mallow	924m to SW
CO033-009001-	Fortified house	Castlelands	965m to SW
CO033-009002-	Country house	Castlelands	889m to SW
CO033-009003-	Ice house	Castlelands	747m to SW
CO033-009004-	Tower house	Castlelands	998m to SSW
CO033-009005-	Hospital	Castlelands	829m to SW
CO033-009006-	Bawn	Castlelands	998m to SSW
CO033-010	Ringfort	Castlelands	865m to S
CO033-011001-	Ringfort	Castlelands	831m to S
CO033-011002-	Redundant record	Castlelands	831m to S
CO33-012	Ringfort	Castlelands	536m to SE
CO033-013	Enclosure	Keatleysclose	373m to E

CO033-014	Enclosure	Parkadallane	600m to E
CO033-088	Lime kiln	Castlelands	963m to S
CO033-089	Enclosure	Keatleysclose	115m to E
CO033-090	Fulacht fia	Castlelands	424m to SE
CO033-091	Fulacht fia	Castlelands	497m to S
CO033-092	Designed landscape feature	Castlelands	920m to SSW
CO033-093	Historic town	Mallow	942m to SW
CO033-126	Standing stone	Mallow	472m to W
CO033-129	Railway bridge	Leaselands/Spaglen	704m to NW
CO033-139	Industrial site	Ballyviniter Lower	800m to N
CO033-140	Excavation/miscellaneous	Castlelands	835m to S

Table 1: RMP/SMR sites within a 1km radius of the proposed development site

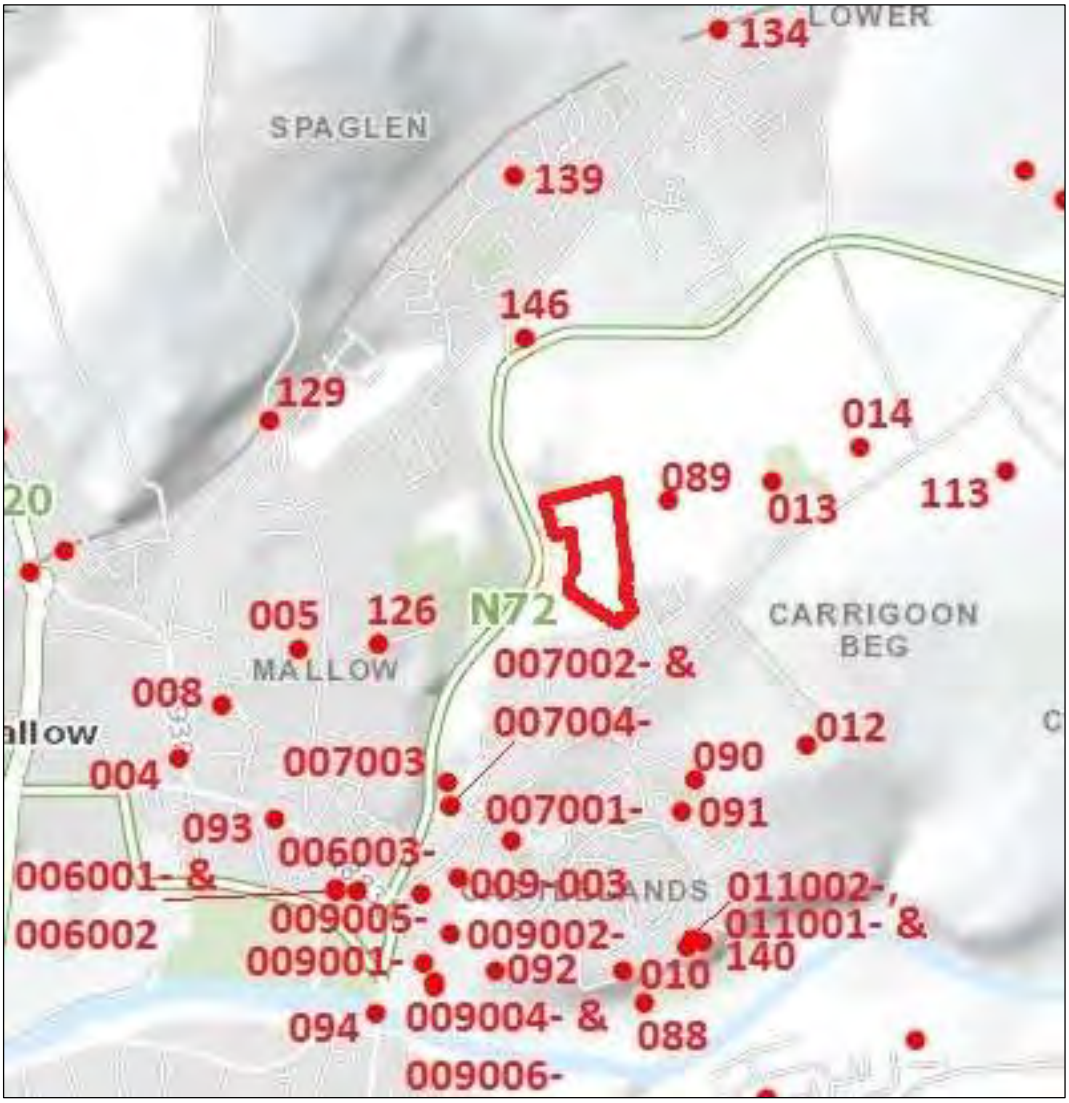

Figure 3: Proposed development site outlined in red showing archaeological monuments within a 1km radius (www.archaeology.ie)

2.3 Four of the recorded archaeological monuments within the 1km radius are prehistoric in date. There are two fulachtaí fia (CO033-090 and 091) in Castlelands, a standing stone (CO033-126) in Mallow and a Neolithic/Bronze Age pit (CO033-140) also in Castlelands. Fulachtaí fia are generally interpreted as ancient

cooking sites, but could have been used for any purpose that required large quantities of hot or boiling water. They usually survive as a spread, or mound, of heat-shattered and burnt stone. The burnt stone generally fills and covers one or more troughs or pits cut into the ground. The trough, which was sometimes lined with timber, wattle or stone, was generally excavated below the water table, near a spring or stream and allowed to fill with water. A fire was set adjacent to the trough, to heat stones, and the water was then heated or boiled by immersing the fire-heated stones in it. Experiments have shown that large quantities of water can be boiled in this way in about twenty minutes and joints of meat wrapped in straw can be cooked over several hours. After each use the burnt and heat-shattered stones would have to be cleaned out of the trough. Over time this material accumulated to form a crescent shaped mound of burnt material around the trough. Fulachtaí fia are usually dated to the Bronze Age (2400-500BC), although a minority of excavated examples have been dated to the early historic periods. Although they are generally interpreted as cooking sites they were also used for bathing, processing textiles, tanning, brewing, extraction of fats from meat, and soap making, or even a combination of these functions (Ó Drisceoil, 1988; Monk 2007; Quinn & Moore 2007).

The two fulachtaí fia in Castlelands (CO033-090 and CO033-091) were investigated in 2004. Their extent was established and they were retained *in situ* within buffer zones in a residential development (Purcell 2004).

Standing stones may have had a number of functions in the prehistoric landscape. They were often erected in prominent locations and may have marked routeways or tribal boundaries but others may have marked burials or had a ceremonial or ritual purpose. More recent examples may have been erected as scratching posts for animals. The example in Mallow (CO033-126) is described as being square in plan with no obvious alignment recorded. It was removed in 2003 for repair after being damaged during nearby development work (Ronan *et al* 2009).

The pit feature (CO033-140) in Castlelands was identified during archaeological monitoring in advance of a housing development and was subsequently excavated. Three sherds of pottery found in the pit dating to the Neolithic/ Bronze Age indicated the pit was of a prehistoric date (Lane, 2002).

2.4 There are a number of recorded monuments dating to the early medieval period within the 1km radius of the proposed development site. These include the ringforts in Castlelands (CO033-010, CO033-011001- and CO033-012) and presumably the enclosures in Keatleysclose (CO033-013 and CO033-089) and Parkadallane (CO033-014). The holy wells in Spaglen (CO033-007003- and CO033-007004-) may also date to the early medieval period although one of the wells (CO033-007004-) was used as spa well from the 18th century. The early medieval period is characterised by the introduction of Christianity from the late 4th century onwards, becoming widely established during the second half of the sixth century. Ringforts (also known by the names rath, lios, cathair or caiseal/cashel) are defended farmsteads and are the most characteristic monument of this period. Their main phase of construction and occupation dates from the beginning of the 7th century AD to the end of the 9th century. They are generally circular or oval in plan, defined by an earthen bank with an external ditch or fosse. Larger ringforts with double defences (bi-vallate) and triple defences (tri-vallate) are generally interpreted as higher status sites and these can be particularly associated with specialised craft working. The sub-surface remains of circular dwelling houses and associated outbuildings are frequently revealed within ringforts during excavation. Some ringforts have associated souterrains (underground chambers connected by narrow creepways) as defensive features which may have also been used for storage. Others have associated corn-drying kilns and sometimes external structures. Generally, it has been speculated that the elite of society occupied ringforts and that the less wealthy lived in undefended settlements scattered across the landscape. In more recent archaeological investigations, particularly on road infrastructure projects in Co. Cork, the number and type of unenclosed medieval settlements identified has been growing, suggesting more diversity in contemporary settlement patterns (Monk, 2019) and challenging the perceived importance of ringforts within the early medieval landscape.
Archaeological investigations were undertaken in the vicinity of the three ringforts in Castlelands (Purcell 2000 and 2004). Archaeological deposits were identified in the vicinity of the levelled ringfort (CO033-

011001-) which were preserved *in situ* (Purcell 2000). No deposits were identified in the vicinity of the other two (CO033-010 and CO033-012).

Enclosures are monuments which are generally levelled with no above ground remains surviving; many are recorded as cropmarks on aerial photographs and the three within the study area were identified in this way (Power and Lane, 2000). The three presented as circular or oval cropmarks suggesting they represent the remains of levelled ringforts.

The tradition of visiting holy wells goes back to the very beginnings of Irish Christianity, but most wells probably have their origin in pre-Christian ritual activities. The majority of the 'wells' are springs or just depressions in rocks where rainwater collects; some have more recently constructed stone or concrete surrounds (Logan, 1992, 171). Some wells are still maintained for holy use when at certain times of the year they are visited in the form of a pilgrimage often referred to as a 'round' or 'pattern'. Other wells are known through tradition for their reputed curative properties. Logan (*ibid.*, 116) notes the long tradition of visiting holy wells down through the centuries and lists many of the customs, such as votive offerings, associated with these sites. Offerings are an essential part of the pilgrimage and can consist of money, stones, pieces of cloth, buttons, brooches and other everyday items. Sometimes these may be left at the side of the well, tied to a nearby tree or thrown into the well itself. Holy wells are so abundant in Ireland that most parishes in the country have at least one such site, whether in use or not (*ibid.*). One of the holy wells at Spaglen (CO033-007004-) was dedicated to St Patrick although Lewis associates it with St Peter (Power and Lane 2000). It is noted that it is no longer in holy use.

2.5 The proposed development site lies on the northeastern outskirts of the historic town of Mallow (CO033-093). The historic town lies on the north side of the River Blackwater and has medieval origins which probably date to the late 12th century when the Anglo-Normans reputedly built a castle here (Power and Lane, 2000, 596). This settlement may not have been very substantial as the town fell into decline during the later medieval period. It remains uncertain whether the town was ever walled, although some evidence suggests it was defended (Thomas 1992, 231). The town was re-established during the plantation of Munster with numbers of settlers growing steadily. In 1611 there were twenty-five settlers in Mallow and by 1641 there were nearly 200 houses. In 1642 the town was attacked by the Irish and partially burnt, however, it survived and during the eighteenth and nineteenth centuries it grew and prospered as a market and spa town (Power and Lane, *ibid.*). Lewis (1837) describes the town as …*'a market town…containing 9804 inhabitants…the town…formed part of the territories of the great Earl of Desmond…The town is finely situated on the northern bank of the river Blackwater, about a mile below its confluence with the Clydagh…chiefly of one main street on the mail coach road from Cork to Limerick, near one extremity of which was Castle Garr, on the site of which is now a modern house; and at the other is Mallow Castle, commanding the river, over which is a stone bridge of eleven arches…'*

The remains of a tower house and bawn (CO033-009004- and CO033-009006-) lie in Castlelands on the north bank of the River Blackwater. The tower house may have been built on the remains of an earlier castle. A fortified house (CO033-009001-) lies nearby overlooking the bridge on the Blackwater. The house was built by Sir Thomas Norris who was granted the Manor of Mallow during the Munster plantation. Norris died in 1599 and the house was ruined by the Confederate forces in 1645 and burnt down in 1689 (*ibid.)*.

Other recorded archaeological sites within a 1km radius of the proposed development site include a lime kiln in Mallow (CO033-005) to the west, two in Castlelands (CO033-088, CO033-007001-) to the south and southwest, two churches (CO033-006002-, CO033-008), a graveyard (CO033-006001-), a hospital (CO033-009005-) and market house (CO033-006003-) in Mallow to the southwest and a spa/bath (CO033-007002-) in Spaglen. A country house (CO033-009002-), ice house (CO033-009003-) and a designed landscape feature (CO033-092) show the continued use of the demesne into the 18th-20th centuries. These sites reflect the various religious, secular and industrial aspects of the lives of the inhabitants in the area since it's foundation in the 12th century and its development as a plantation town.

2.6 No archaeological work has been undertaken in the immediate area of the proposed for development. Just one archaeological investigation is recorded in the excavations bulletin (www.excavations.ie) for the townland of Spaglen. A large number of archaeological excavations have been undertaken in Mallow town. Material dating to the 17th century was identified in the town, in Bridge Street, during archaeological monitoring and this material was preserved *in situ* (Lane 1997), otherwise archaeological material has not been identified during archaeological investigations in the town (www.excavations.ie). A large number of archaeological investigations have been undertaken in the adjoining townland of Castlelands, as outlined above, where large residential developments were undertaken during the early 2000s.

2.7 The OS 6-inch map of 1842 (Fig. 4) depicts the area of the proposed development site as two complete fields and part of a third on the eastern side of the Spa Glen valley. The Spa Glen stream lies a short distance to the west separated from the proposed development site by open fields. There are also open fields to the south and north. The site is bordered on the east side by the townland boundary with Keatleysclose. There is a small unnamed rectangular structure directly outside the NE corner. There are no features or structures depicted within the proposed development site.

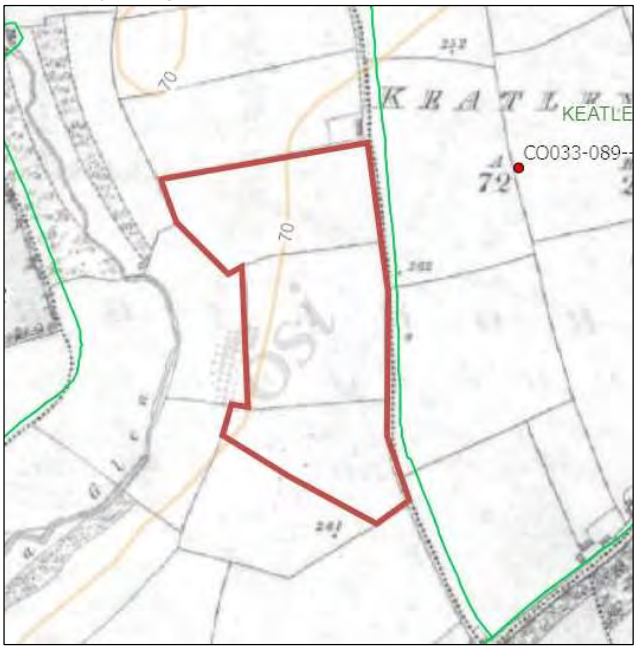

Figure 4: Extract from OS 6-inch map (1842), with proposed development site outlined in red (www.archaeology.ie)

The field layout remained unchanged on the 25-inch OS map (1897-1903) (Fig. 5). But the N72 road/ Spa Walk has been constructed in the Spa Glen valley crossing the meandering course of the Spa Glen stream. The unnamed structure outside the northeastern corner is no longer depicted. The site remains unchanged again on the 1933 6-inch OS map (not included).

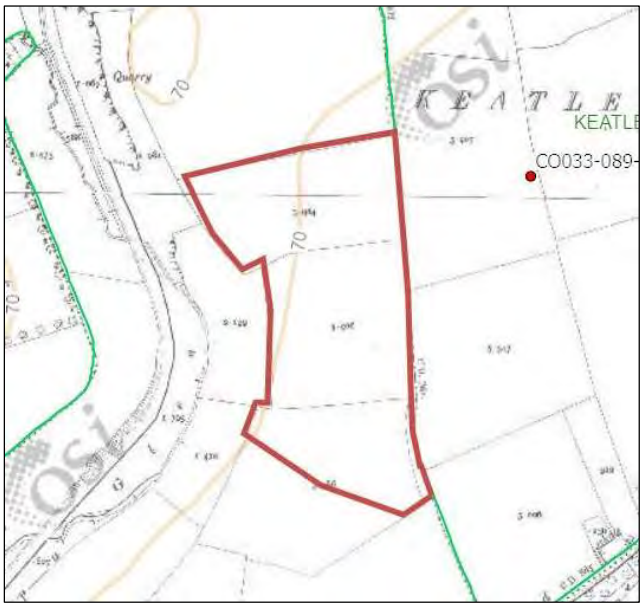

Figure 5: Extract from OS 25-inch map (1903), with proposed development site outlined in red www.archaeology.ie

3 Archaeological Testing

3.1 Archaeological testing was carried out on this site over three days, commencing on the 3rd of October 2023 under licence 23E0624. A total of twenty trenches were mechanically excavated across the proposed development site (Fig. 6) in mixed and sometimes very wet weather conditions. Trenches 1 to 14 were excavated in Field 1, the larger field to the north and Trenches 15 to 20 were excavated in Field 2 to the south. Trenches 8-10 were opened across Anomaly 1, Trench 11 across Anomaly 2 and a part of Anomaly 3, Trenches 3-7 and 12 across parts of Anomaly 3 in Field 1 and Trenches 15-19 across parts of Anomaly 4 in Field 2. All trenches were 1.8m wide, except where extended. A synopsis of the deposits revealed in the test trenches is given in Table 2 below.

3.2 A number of features of archaeological significance and/or potential archaeological significance were identified in Trenches 7 – 11 and Trench 18, corresponding with Anomalies 1, 2, parts of Anomaly 3 and one part of Anomaly 4. They were numbered Feature 2 (F2) to Feature 13 (F13), Feature 1 being the topsoil. A portion of these features was investigated by hand to assess their nature and extent. The County Archaeologist had recommended that preservation *in situ* would be required if significant archaeological remains were identified. Therefore once archaeological features were identified the investigations focused on defining the outer extent of the features and internal elements were not further investigated (as they would be within any required buffer zone). No features of archaeological significance were identified in Trenches 1 – 6, 12 – 17, 19 and 20.

3.3 Anomaly 1 the circular enclosure and the encircling trend outside it curving clockwise from north to west were evident in the form of poorly defined shallow ditches. The enclosure ditch was identified in Trenches 8, 9 and 10 as F4, F6 and F8 respectively. Where investigated, it varied in size from 0.5m deep and 1.5m wide (in Trench 8) to 0.17m deep and 0.9m wide (in Trench 9). One possible internal feature (F7) was identified but not investigated in Trench 10. The trend outside the circular enclosure was identified as a shallow ditch (F5) in Trench 9, up to 1m wide and 0.2m deep and as F9 in Trench 10 where it was 0.8m wide and 0.5m deep. The enclosure and the associated features were ephemeral in nature, generally quite shallow and poorly defined. Their poor definition caused some truncation during testing but the upper truncated portions were generally discernible in the trench edge/ section. All features identified in Trenches 8, 9 and 10 are considered to be of archaeological significance.

3.4 Anomaly 2, the circular trend, and one part of Anomaly 3 were identified in Trench 11. A shallow ditch (F11) (0.28m deep x 0.9m wide) was found to correspond with the northern end of Anomaly 2 while a mid-brown stoney band (F12), 2.7m wide, related to the southern end of the anomaly. This was not further investigated. Internally a cluster of three possible postholes or small pits were identified but not further investigated. The part of Anomaly 3 to the north of the circular trend was identified as a charcoal-flecked and scorched deposit (F10), it was not further investigated. All features identified in Trench 11 are considered to be of archaeological significance.

3.5 Two elements of Anomaly 3 were investigated in Trench 7 and appeared to be large vertically cut pits (F2 and F3) lying between 10m and 40m east of Anomaly 1. It was not possible to establish if they were related to it (Anomaly 1) but their substantial nature was in contrast to the ephemeral nature of Anomalies 1 and 2. One part of Anomaly 4 investigated in Trench 18 in Field 2 was also a vertically cut large pit (F13). Although in excess of 200m south of F2 and F3 it appeared to be of a similar scale and nature. These three features are considered to be of archaeological potential.

3.6 Other elements of Anomalies 3 and 4 investigated in the trenches were of no archaeological significance and appeared to relate to possible tree root burning and removal (Trenches 3 and 4), underlying geology (Trench 5), modern disturbance/dumping (Trench 12) or not discernible (Trenches 15-17 and 19).

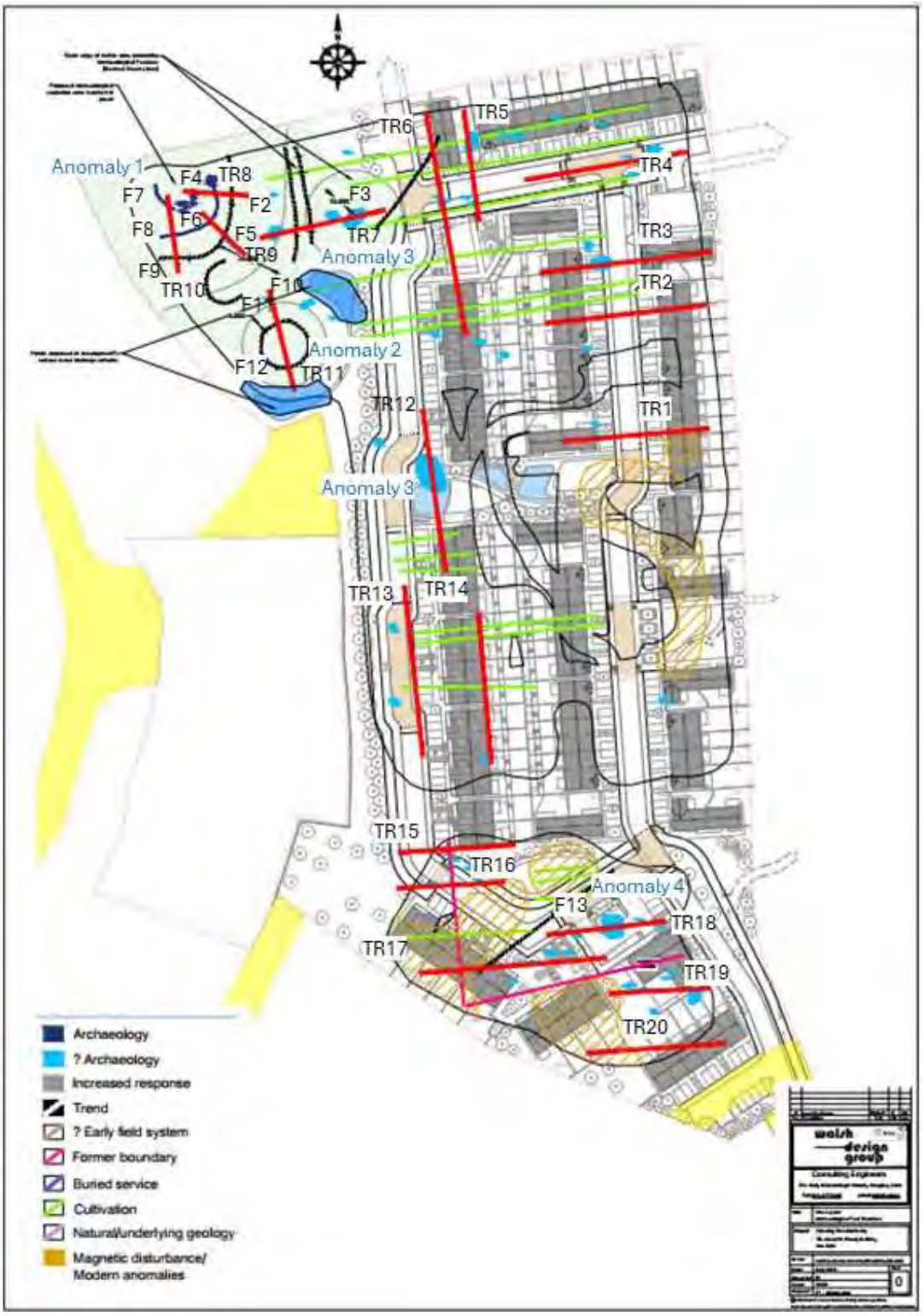

Figure 6: Trenches 1-20 overlaid on the results of the geophysical survey and proposed development layout (after Walsh Design Group)

Trench No.	Description
Trench 1	45m long, oriented EW. 0 – 0.28m Topsoil 0.28 – 0.45m Light brown-orange clay loam with occasional stones and charcoal. Topsoil was present at the eastern end of the trench only, it had been previously stripped from the centre and western end. Subsoil was quite rooty at the eastern end under the tree line.
Trench 2	50m long, oriented EW. 0 – 0.31m Topsoil 0.31 – 0.41m Light brown-orange clay loam with occasional stones and charcoal. A furrow 0.04m deep by 0.33m wide extended intermittently along the trench. The trench was quite disturbed at the eastern end near the tree line, and appeared to extend along the line of a field boundary depicted on the 19th and 20th century OS maps. A deposit of stone 1.3m wide and a buried humic deposit at a depth of 0.75m below the existing ground surface appeared to represent a backfilled drain and a modern stone drainage feature associated with the field boundary.
Trench 3	54m long; oriented EW. Opened across part of Anomaly 3. 0 – 0.32m Topsoil 0.32 – 0.45m Light brown-yellow clay loam with occasional stones and charcoal. A furrow 0.1m deep was apparent at the eastern end. The part of Anomaly 3 within the trench was towards the western end and corresponded with an area of brown humic silty clay and slightly scorched clay. This was identified at a depth of 0.65m below ground level and was irregular and appeared to relate to tree root burning.
Trench 4	52m long; oriented EW. Opened across a part of Anomaly 3. 0 – 0.25m Topsoil 0.25 – 0.48m Mid-orange-brown clay loam with occasional stones and charcoal. 0.48 – 0.6m Light orange-yellow pebbly cobbly clay band approximately 10m long and corresponding to the part of Anomaly 3 at the eastern end of the trench. This was quite disturbed and mixed and appeared to relate to relatively modern disturbance, possibly related to removal of trees. The rest of the trench was less gritty and cobbly.
Trench 5	35m long; oriented NS. Opened across a part of Anomaly 3. 0 – 0.25m Topsoil 0.25 – 0.5m Light yellow-brown clay loam with occasional stones and charcoal. 0.5 – 0.65m Light brown-orange loamy clay with occasional stone. An area of slightly less stoney subsoil corresponded with the part of Anomaly 3 at the northern end of the trench.
Trench 6	67m long; oriented NS. Opened across a part of Anomaly 3. 0 – 0.28m Topsoil 0.28 – 0.45m Mid-orange-brown clay loam 0.45 – 0.6m Light yellow-brown clay loam with occasional stones and charcoal. No evidence of the anomaly was apparent.
Trench 7	39.7m long; oriented EW. Opened across two of parts of Anomaly 3 and the trench extended across a notable dip in the field rising to the east and west. 0 – 0.28m Topsoil 0.28 – 0.5m Light brown-orange clay loam. Features were identified at both the eastern (F3) and western (F2) ends of the trench corresponding with the parts of Anomaly 3 identified in the geophysical survey. The trench was extended to the north in both locations to identify the northern extent of both features. At the western end the trench was extended by 4m to the north. The western feature (F2) was a well-defined, sub-circular spread of soft mid-red-brown silty clay at the surface. Its measured 3.5m diameter where exposed. A section 0.8m long (NW SE) by 0.3m wide was hand excavated from the southern edge of the spread. The section was 0.4m deep and revealed a vertical edge to the feature but the base was not exposed. The fill was quite soft and sticky with a humic component and moderate charcoal flecking. No finds were identified. While the depth of the feature was not ascertained its vertical edge indicated it was deliberately cut and was probably a large pit.

	At the eastern edge of the trench F3 was visible as a spread of mid-brown soft silty clay with moderate charcoal inclusions and occasional stones, corresponding with the eastern part of Anomaly 3 in the trench. It measured approximately 7m EW and its eastern side was poorly defined. The trench was extended north for 4.5m to reveal the northern edge of the spread. Although its southern edge was not established, the spread could be seen to run into the southern baulk of the trench and the exposed area of the spread was measured at 5.1m NS. A section, 0.3m wide, was hand excavated from the northern edge of the spread for a length of 2.4m. From the northern edge the deposit sloped gradually for a length of 1.7m towards the centre to a depth of 0.18m at which point a vertical edge was identified and followed. The spread was investigated to an overall depth of 0.4m at which point excavation ceased. The base was not reached and no finds were identified but a clear vertical edge to the feature was identified indicating this was deliberately cut. The location of the deposit, close to the natural dip in the field may have resulted in in-wash of soil from above the feature masking its edges and possibly exaggerating its diameter at the surface, however it appears to be a substantial cut feature, probably a large pit similar to F2. No finds were recovered from either feature, the date of both remains unknown. Both are considered to be of archaeological potential.
Trench 8	13.3m long; oriented EW. Opened across Anomaly 1. 0 – 0.35m Topsoil 0.35 – 0.5m Light brown-yellow clay loam with occasional stone A band of mid-brown soft silty clay (F4) with occasional charcoal and stone was visible extending across the trench for a width of approximately 1.2m which broadly corresponded with the location of the ditch of the enclosure (Anomaly 1) as identified in the geophysical survey. A section 0.3m wide was hand excavated across it and it was found to be ditch 0.2m deep with sloping sides and a slightly flat base. The upper portion of the ditch was truncated during trenching but was partially visible in the side of the trench. It suggested and overall width of 1.5m and depth of 0.5m of the ditch No finds were identified in the trench. F4 is considered to be of archaeological significance.
Trench 9	14.2m long; oriented NW SE. Opened across Anomaly 1. 0 – 0.35m Topsoil 0.35 – 0.5m Light brown-yellow loamy sandy clay. Two poorly defined curving and parallel bands (F5 and F6) were visible extending across the trench corresponding with Anomaly 1. The outer one (F5) broadly corresponded with the trend identified in the geophysical survey. It comprised a spread of mid-red-brown slightly silty loamy clay, up to 1m in width and 0.2m in depth with a U-shaped profile. This appears to represent the truncated remains of a shallow ditch. A band of mid-brown loamy clay (F6) was identified at the NW end of the trench and broadly corresponded with the location of the ditch of the enclosure identified in the geophysical survey. Its profile was visible in the trench section and could be seen to be up to 0.9m wide and 0.17m deep. Both features were poorly defined and quite shallow. The ditch (F6), in particular, was shallow and ephemeral in nature. No finds were identified in the trench. F5 and F6 are considered to be of archaeological significance.
Trench 10	26m long; oriented NS. Opened across Anomaly 1. This area of the site had been subject to some disturbance. Topsoil was removed from the NW corner of the field at the crest of the hill. 0 – 0.05m Sod 0.05 – 0.35m Firm light brown-yellow clay loam with occasional stones A number of poorly defined features (F7, F8 and F9) were identified in the trench broadly corresponding with Anomaly 1. The possible internal feature of the enclosure (F7) was identified as a band of soft, mid-yellow-brown silty clay, 0.5m wide, adjoined by a sandy pocket (2m wide) on its south side. This was not further investigated. A band of red-brown soft silty clay (F8) (3m wide) corresponded with the ditch of the enclosure. This was not further investigated.

	The trend (F9) was visible as a 0.8m wide band of mid-brown soft, slightly gritty silty clay with occasional charcoal which extended across the trench. This could be seen in the trench section to extend to a depth of 0.2m. A small section, 0.3m wide, was hand excavated across it and this reached a further depth of 0.3m, giving an overall depth of 0.5m. It was found to have steeply sloping sides and a flat base and appeared to be a shallow narrow ditch. No finds were identified in the trench. F7, F8 and F9 are considered to be of archaeological significance.
Trench 11	33.2m long; oriented NS. Opened across Anomaly 2 and one part of Anomaly 3. The trench sloped quite steeply from north down to south. 0 – 0.3m Topsoil 0.3 – 0.4m Light brown-orange stoney loamy clay cut by furrows approximately 0.6m wide and 0.1m deep. At the northern end of the trench the possible archaeological features identified in the geophysical survey as a part of Anomaly 3 corresponded with a charcoal-flecked spread of dark brown loamy clay (F10) with an adjoining pocket of scorched clay on its southern side. This measured 1.1m NS by 0.6m EW and extended into the western trench baulk. The deposit appeared to be of archaeological significance and was not further investigated. Towards the centre of the trench the northern end of Anomaly 2, the circular trend, corresponded with a 0.9m wide deposit of mid-brown loamy clay (F11) crossing the trench. A hand excavated section across it reached a depth of 0.28m. Its southern side was slightly shallow, sloping gradually to an undulating base. The northern side was deeper (0.28m) with a steeply sloping side and a tapering base which may not have been bottomed. This appeared to represent a small ditch. At the southern (downslope) end of the trench a mid-brown stoney clay band (F12) 2.7m wide was identified which appeared to correspond to the southern side of the circular trend in the geophysical survey. The definition of the northern side of the band was poor as it merged into an adjoining similar band separated by a small stoney concentration. The feature was not further investigated. Between F11 and F12 three closely-set small, subcircular features were identified (measuring 0.4m x 0.45m; 0.62m x 0.6m; and 0.3m x 0.6m). The three were dark brown charcoal-flecked, silty clay deposits and were not further investigated, but suggested the presence of small pits or post holes. F10, F11 and F12 as well as the three closely-set, subcircular features are considered to be of archaeological significance.
Trench 12	60.2m long; oriented NS. Opened across a part of Anomaly 3. 0 – 0.4m Topsoil 0.4 – 0.5m Mid-brown-orange clay loam very stoney The large element of Anomaly 3 identified in the geophysical survey towards the north of centre of the trench corresponded with a substantial deposit of dark grey-brown stoney loose mixed clay, which contained inclusions of modern pottery, glass and brick. This extended for 11m in the trench. It was mechanically excavated to a depth of 2.4m, at which point the sides of the trench began to collapse and excavation ceased. This appeared to relate to late 19th /20th century dumping.
Trench 13	54m long; oriented NS. 0 – 0.4m Topsoil 0.4 – 0.55m Light brown-yellow clay loam very stoney, especially at the southern end with pockets of light grey stoney clay in places. A band of hard light grey-brown stoney gravel ran across the trench for a length of 11m towards the southern end. No features of archaeological potential/significance were noted.
Trench 14	36.2m long; oriented NS. 0 – 0.5m Rooty dark topsoil with some modern pottery and brick 0.5 – 0.65m Lighter brown topsoil mixed with subsoil with modern pottery and brick evident. 0.65 - 0.8m Mid-brown-orange clay loam with moderate stone inclusions. Furrows 0.6m wide x 0.07-0.1m depth were evident running EW across the trench. No features of archaeological potential/ significance were noted.
Trench 15	36.3m long; oriented EW. Opened across a part of Anomaly 4. 0 – 0.35m Topsoil

	0.35 – 0.55m Mid-brown-orange clay loam at the west and mottled brown-yellow-orange at the east of the trench. No evidence of the anomaly was apparent.
Trench 16	34.2m long; oriented EW. Opened across a part of Anomaly 4. 0 – 0.4m Topsoil 0.4 – 0.5m Mid-brown-orange clay loam 0.5 – 0.6m Light brown-yellow-grey clay loam with occasional stone at the west end and mid-brown-orange stoney clay loam at the eastern end of the trench. No evidence of the anomaly was apparent.
Trench 17	80.2m long; oriented EW. Opened across a part of Anomaly 4. 0 – 0.3m Topsoil 0.3 – 0.4m Mid-brown-orange clay loam with pockets of light grey gravelly clay Topsoil was present from the centre of the trench to the eastern end only, it had been previously stripped from the western portion. No evidence of the anomaly was apparent.
Trench 18	58m long; oriented EW. Opened across a part of Anomaly 4. 0 – 0.15m Topsoil 0.15 – 0.25m Mid-brown-yellow stoney clay loam. A large deposit of mid-red-brown silty clay (F13) was identified measuring 5.5m EW towards the centre of the trench and corresponding to a large circular anomaly identified in the geophysical survey. A sherd of white delph was noted at the surface of this deposit, however, poor weather conditions made it difficult to determine whether this had fallen from overlying topsoil or whether it was *in situ*. The deposit was investigated by machine to a depth of 1.5m at which point excavation ceased. The trench was subsequently extended 3.5m to the south to determine the southern extent of the feature. It was exposed for a length of 4.4m to the northern trench edge but the northern edge was not exposed. No further finds were identified. This appeared to be a large pit, similar in scale to F2 and F3 and located 230m to the north in Trench 7. The pit is considered to be of archaeological potential. No associated features were identified in the southern end of the proposed development site.
Trench 19	29m long; oriented EW. Opened across a part of Anomaly 4. The trench was slightly disturbed at the eastern end 0 – 0.3m Topsoil 0.3 – 0.45m Light yellow loamy clay with inclusions of stones 0.45 – 0.5m Light grey-yellow firm stoney clay subsoil. No evidence of the anomaly was apparent.
Trench 20	38.5m long; oriented EW. Some disturbance was apparent and marks from machine teeth were apparent cutting subsoil. 0 – 0.22m Topsoil 0.22 – 0.4m Light yellow-grey-brown gritty sandy clay with inclusions of stone. No features of archaeological potential/ significance were noted.

Table 2: Deposits revealed in Trenches 1-20

Plates 1 & 2: Trench 1, looking E Trench 2, looking E

Plates 3 & 4: Trench 3, looking W Trench 4, looking E

Plates 5 & 6: Trench 5, looking N Trench 6, looking S

Plate 7: Trench 7, looking E, showing F2 (before trench was extended) in foreground and F3 in background

Plate 8: Trench 7, F2 showing hand dug section from southern edge of pit, looking N

Plate 9: Trench 7, F3 showing section, looking E

Plate 10: Trench 7, F3, western edge highlighted by arrow, looking W

Plate 11: Trench 8, showing section across F4, looking NW

Plate 12: Trench 8, showing section across F4, looking SW

Plate 13: Trench 9, looking NW with F5 in foreground and F6 in background (both indicated by arrows)

Plate 14: Trench 10, possible enclosure ditch (F8), looking north

Plate 15: Trench 10, ditch (F9), looking N

Plate 16: Trench 11, F10, looking N

Plate 17: Trench 11, section across F11, looking N

Plate 18: Trench 11, showing archaeological features (small pits and postholes) inside circular trend, looking N

Plate 19: Trench 12, looking N

Plate 20 & 21: Trench 13, looking N

Trench 14, looking N

Plate 22 & 23: Trench 15, looking E

Trench 16, looking W

Plate 24 & 25: Trench 17, looking E

Trench 18, looking E

Plate 26: Trench 18, showing southern edge of F13 visible in trench extension, looking north

Plate 27 & 28: Trench 19, looking E

Trench 20, looking W

4 Conclusion and Recommendations

4.1 The proposed development site is located in Spaglen townland less than a kilometre NE of Mallow town, Co. Cork. It is accessed from St Josephs Road and lies to the east of the N72. It comprises two irregular, pasture fields which have been subject to some previous disturbance and topsoil stripping.

4.2 Cork County Council are proposing to construct a residential development on the site with all associated ancillary services.

4.3 There are no recorded archaeological monuments within the proposed development site. The closest recorded site is an enclosure (CO033-089) 115m to the east in the adjoining townland of Keatleysclose. It is likely to represent a levelled ringfort.

4.4 Archaeological geophysical survey (Murphy 2023) identified a number of features of archaeological significance, potential archaeological significance, trends, linears, cultivation remains and modern anomalies on the site. These were numbered for clarity in this report as follows:

- Anomaly 1 – Circular enclosure, internal features and surrounding curvilinear trend curving clockwise from north to west in NW corner of Field 1
- Anomaly 2 – Curvilinear trend, possible ring ditch, south of Anomaly 1 in NW corner of Field 1
- Anomaly 3 – Positive responses possible pits, postholes, cut features, large pits and spreads in Field 1
- Anomaly 4 – Positive responses possible pits, postholes, cut features, large pits and spreads in Field 2

4.5 Twenty trenches were mechanically excavated across the proposed development site and the geophysical anomalies in October 2023. A number of features of archaeological significance were identified and the presence of the circular enclosure and enclosing trend (Anomaly 1) was confirmed in the NW corner as well as the smaller curvilinear trend, possible ring ditch, (Anomaly 2) also in the NW corner and to the south of Anomaly 1. A small archaeological feature, F10, (part of Anomaly 3) was identified to the north of Anomaly 2. Two other parts of Anomaly 3 (F2 and F3) were identified as features of archaeological potential also in the NW corner of the proposed development site. One outlying feature of archaeological potential, F13, (part of Anomaly 4) was identified in the southern end of the proposed development site in Field 2. The majority of the features of archaeological significance/potential identified corresponded with those detected in the geophysical survey.

4.6 Anomaly 1, the circular enclosure and the encircling trend curving outside it, were identified as shallow ditches (respectively F4, F6, F8 and F5 and F9) with an internal feature (F7). There was evidence of some previous disturbance and topsoil stripping in this part of Field 1 which may have truncated or damaged parts of these features. Notwithstanding such truncation, the features were ephemeral in nature and poorly defined. The shallow, small scale and ephemeral nature of the ditches defining the enclosure suggests they were more likely of ritual significance than defensive features. As defensive features they would have been ineffective given their small scale and were more likely to have defined the boundary of the area within their perimeter rather than defending it. The features identified represent an enclosure of unknown date but do not suggest the presence of a levelled ringfort on the site. The curvature of the ditch corresponding with the curving trend outside the enclosure, at the north in particular, suggests it may have continued outside the proposed development site with the portion within the proposed development site forming the SE quadrant of a larger circular enclosure. The enclosure is located on elevated ground within an undulating landscape, falling quite steeply to the west to the Spa Glen valley which is heavily wooded. The N72 road (the southern end of which is Spa Walk) was constructed through the valley at the end of the 19th or early 20th century, modifying the rural landscape and possibly cutting the land immediately west of the proposed development site to the steep fall now existing. It is possible the enclosure was at the crest of quite a prominent hill overlooking the valley. It is possible that the remainder of the enclosure, if present, was removed during the construction of the road.

4.7 Anomaly 2, the circular trend, approximately 30m south of Anomaly 1 was defined by a shallow ditch F11 at its northern end and a mid-brown stoney clay band, F12, at the southern end. The features (F11 and F12)

may represent the shallow ditches of a small circular feature approximately 15m diameter and consistent with its presentation in the geophysical survey as a possible ring ditch (Murph 2023). Several features of archaeological significance, postholes or small pits were identified in the interior, but these were not investigated. The features identified as Anomaly 2 in Trench 11 were ephemeral in nature similar to those identified as Anomaly 1. Although no finds were identified associated with either Anomaly 1 or 2 the similar nature of the features and their relative proximity (approximately 30m) suggests they may be associated. An isolated deposit F10 (and part of Anomaly 3) identified at the northern end of Trench 11 and north of Anomaly 2 appears to be of archaeological significance and is probably related to Anomalies 1 and 2.

4.8 The two large pits, F2 and F3, identified as parts of Anomaly 3 in Trench 7, were located between 10m and 40m to the east of Anomaly 1. They were large substantial features ranging in diameter from 3.5m (F2) to 7m (F3), although the diameter of F3 may be partially exaggerated by slumping of overlying soil into a natural dip in the field. Small scale hand investigation indicated they were vertically cut pits of undetermined depth. Finds were not recovered from either feature and their date remains unknown. The large pit, F13, identified in Trench 18 as part of Anomaly 4 was similar in scale to F2 and F3 although 230m further to the south. A sherd of white delph was recovered from the surface of F13, however, this may have fallen from overlying topsoil, given the particularly poor weather conditions prevailing at the time of investigation and may not be directly associated with F13. The date of the three features F2, F3 and F13 is therefore unknown but they are considered to be of archaeological potential. The substantial scale and nature of the three was in sharp contrast to the ephemeral nature of Anomalies 1 and 2 suggesting that they may be unrelated.

4.9 Following confirmation of the presence of significant archaeological remains in the NW corner of Field 1 the proposed residential development was redesigned removing the residential units from the NW corner (Figs. 7 and 8). It is proposed to retain the NW corner as a green area incorporating a buffer zone for the archaeological features and two attenuation ponds required for surface drainage and designed around the archaeological features. The proposed redesign will accommodate the preservation *in situ* of Anomaly 1 the circular enclosure (F4 to F9), Anomaly 2 the circular trend (F11 and F12) to its south, the small deposit F10 (part of Anomaly 3) north of Anomaly 2, and the two large pits F2 and F3 (also part of Anomaly 3) as well as isolated parts of Anomaly 3 which were not investigated. The green area will comprise an irregular buffer zone facilitating the preservation *in situ* of the archaeological deposits, as follows:

- Anomaly 1 will be within a buffer zone at minimum 20m from the edge of the outer element of the enclosure represented by the trend defined in the geophysical survey and identified as F5 and F9 in Trenches 9 and 10 during archaeological testing.
- Anomaly 2 will be retained within a buffer zone at minimum 5m from the edge of the circular trend identified as F11 and F12 during archaeological testing.
- F3 part of Anomaly 3 will be within a 10m buffer
- F2, part of Anomaly 3, will be within the buffer zone of Anomaly 1
- The unnamed C-shaped curvilinear trend, north of Anomaly 2 and south of Anomaly 1 will be within the buffer zone of Anomaly 1
- F10 will be in the buffer zone between Anomalies 1 and 2.

The buffer zone will be securely fenced off in advance of construction. No storage of soils, plant or materials will occur within the buffer zone and a landscape plan will be agreed with Cork County Archaeologist for the buffer zone as a green space within the proposed development.

4.10 Two parts of Anomaly 3 located outside and NE of the buffer zone to Anomaly 2 and SW of the northernmost proposed attenuation pond will be preserved by record through archaeological excavation in advance of development. At the southern end of the proposed development site it is also proposed to preserve by record through archaeological excavation the large pit F13, part of Anomaly 4, identified in Trench 18. The archaeological material will be fully resolved to professional standards of archaeological practice (as outlined in Policy Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands 1999) and in consultation with Cork County Archaeologist and the National Monuments Service (NMS).

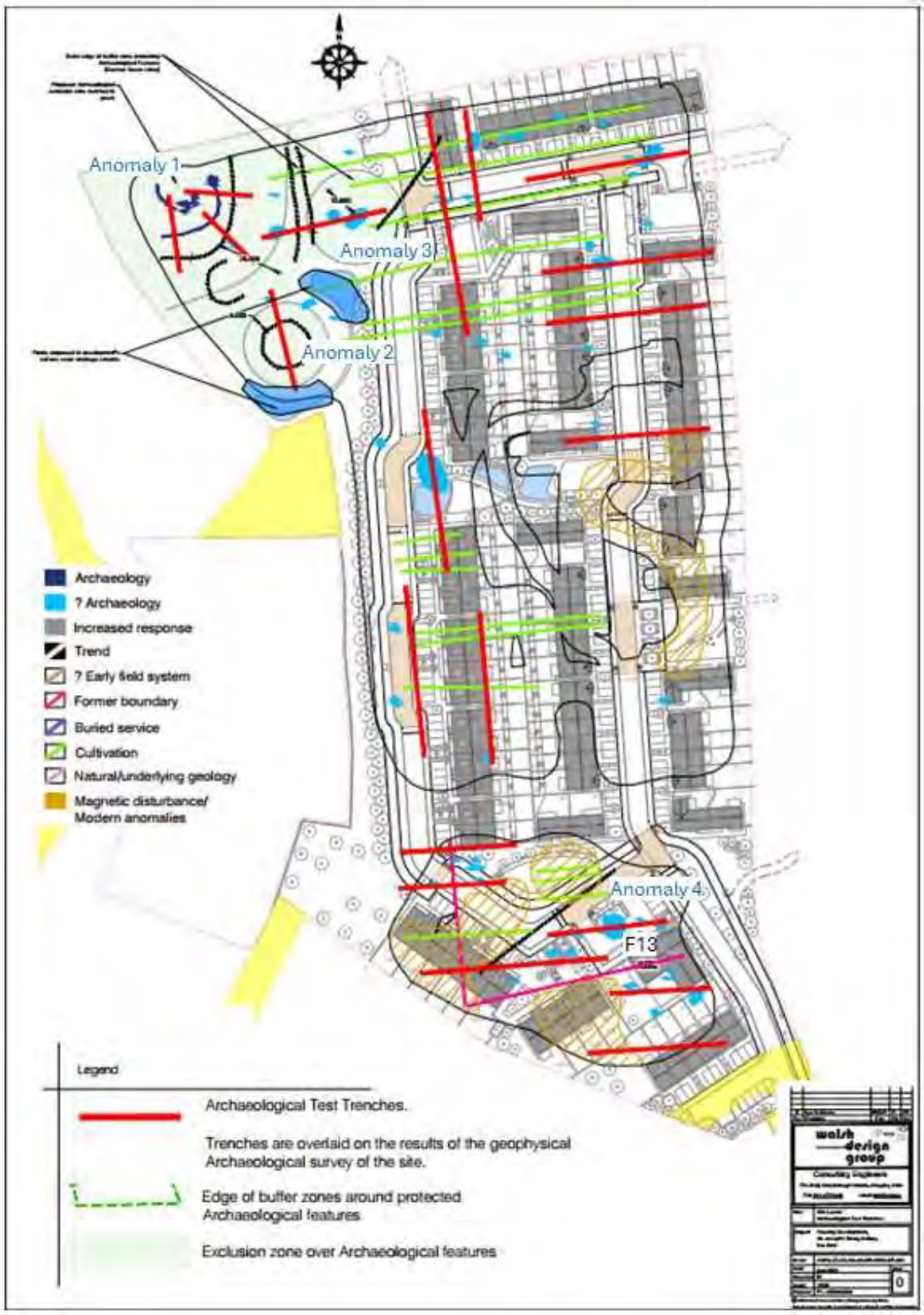

Figure 7: Layout incorporating buffer zone in NW corner and anomalies identified in the geophysical survey (after Walsh Design Group)

4.10 Archaeological monitoring of topsoil stripping associated with the development is recommended. If features or finds of archaeological significance are identified consultation with Cork County Archaeologist and the NMS will be undertaken. All newly identified archaeological sites will be preserved *in situ* or by record and sufficient time and resources will be allowed to resolve all archaeological matters. Preservation *in situ* will require the relocation of any element of the development which may impact on any area of archaeological sensitivity. Preservation by record will require the excavation of the archaeological material and such material will be fully resolved to professional standards of archaeological practice (Policy Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands). Sufficient time and resources will be allowed to resolve all archaeological matters, this work will be funded by the developer.

4.11 All recommendations are subject to approval by the planning authority and the NMS.

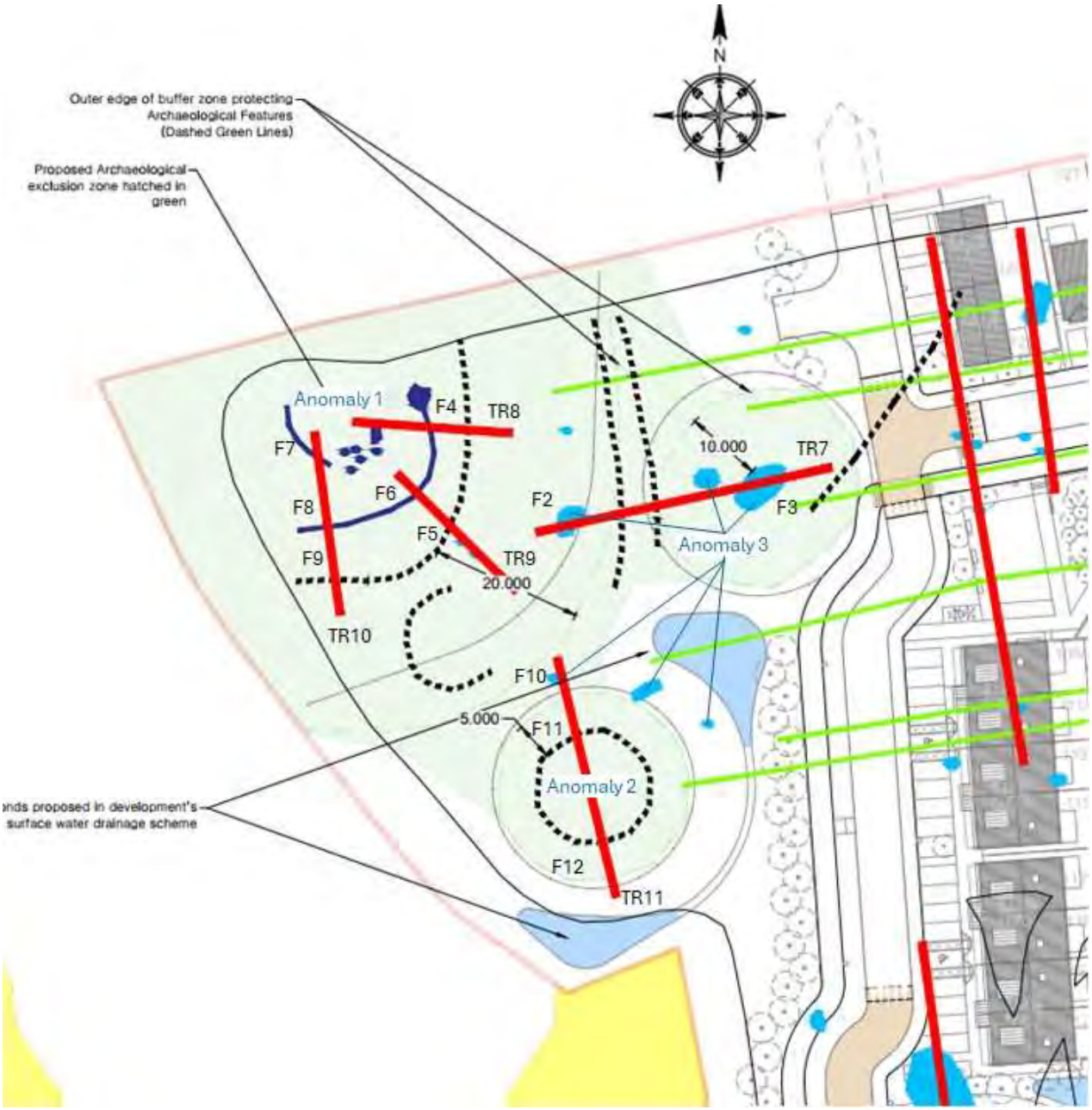

Figure 8: NW corner of propose development showing proposed buffer zone and archaeological features (after Walsh Design Group)

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Report on the Geophysical Investigation at St. Joseph's Road, Mallow Co. Cork For Walsh Design Group

21st April 2023

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THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP23026		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
EURGEOL YVONNE O'CONNELL P.GEO, PH.D., M.SC. (GEOPHYSICS)	TONY LOMBARD M.SC (GEOPHYSICS)	V. 01	21ST APRIL 2023

CONTENTS

1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Walsh Design Group on behalf of Cork County Council to carry out a geophysical survey for a new housing development at St. Joseph's Road, Mallow, Co. Cork. The site is located east of the N72 (Mallow-Dublin Road), northeast of Mallow town. The survey area is c. 4.1 ha in extent.

The geophysical investigation was requested as part of the ground investigation to provide information on the sub-soil conditions across the site including type and thickness of the soils, depth to and type of bedrock, excavatability and the presence of anomalous features.

The Geological Survey of Ireland soils and bedrock maps indicate till derived from Namurian sandstones and shales across the site underlain by pale-grey massive mud-grade limestone of the Hazelwood Limestone Formation. Historical mapping indicates light grey limestone outcrop in the valley directly northwest of the site.

The survey was carried out on the 22nd and 23rd of February 2023 and included EM ground conductivity mapping with follow-up 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling.

The soils have been interpreted as comprising of 3 layers:

1. An upper layer on average 1.4 m thick of soft silt/clay, sandy gravelly silt/clay and/or loose clayey sand/gravel and sand/gravel.
2. Underlain by a layer on average 4.4 m thick of firm to stiff silt/clay, sandy gravelly silt/clay and/or medium dense to dense clayey sand/gravel and sand/gravel.
3. Underlain by a layer on average 10.3 m thick of stiff to very stiff silt/clay and/or sandy gravelly silt/clay.

The interpreted soil thickness ranges from 6.1 m in the northwest to 22.3 m thick in the south.

Bedrock has been interpreted as slightly weathered to fresh limestone at elevations from 51.6 to 72.2 mOD.

The seismic velocities of the bedrock indicate that any excavation will require breaking/blasting. No weathered rock layer has been interpreted from the geophysical data however there may be a thin moderately to slightly weathered rock layer at the base of the 3rd soil layer.

An area with possible buried construction and demolition waste has been interpreted to the southeast of the site.

Seven borehole locations are recommended to confirm the findings of the geophysical investigation.

Where bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, any rotary core drilling, strength testing and trial excavation pits. Trial excavations should be attempted down to formation level using a high-powered excavator of similar rating to that to be used during construction.

The findings of the geophysical investigation should be reviewed following any direct investigation.

2. INTRODUCTION

APEX Geophysics Limited was requested by Walsh Design Group on behalf of Cork County Council to carry out a geophysical survey for a new housing development at St. Joseph's Road, Mallow, Co. Cork. The geophysical investigation was requested as part of the ground investigation to provide information on the sub-soil conditions and map the depth to bedrock across the site.

2.1 Survey Objectives

The objectives of the investigation were to provide information on:

- Sub-soil conditions across the site,
- Type and thickness of the soils,
- Depth to and type of bedrock,
- Excavatability,
- Presence of anomalous features.

2.2 Site Background

The site is located east of the N72 (Mallow-Dublin Road), northeast of Mallow town. The survey area is c. 4.1 ha in extent (Fig. 2.1). Site topography rises from 65 mOD in the northwest to 87 mOD in the southeast. A valley runs along the western boundary of the site with topography dropping to c. 55 to 60 mOD.

An area of topsoil has been stripped in the centre-east of the site with an adjacent low-lying mound or stockpile to the south.

Fig 2.1: Location map (site marked in magenta).

2.2.1 Soils

The Geological Survey of Ireland (GSI) soils map for the area (GSIa, 2019) indicates that the soils across the site comprise of till derived from Namurian sandstones and shales (Fig. 2.2). karstified bedrock outcrop/subcrop is indicated to the west of the site and urban desposits to the south and southeast of the site.

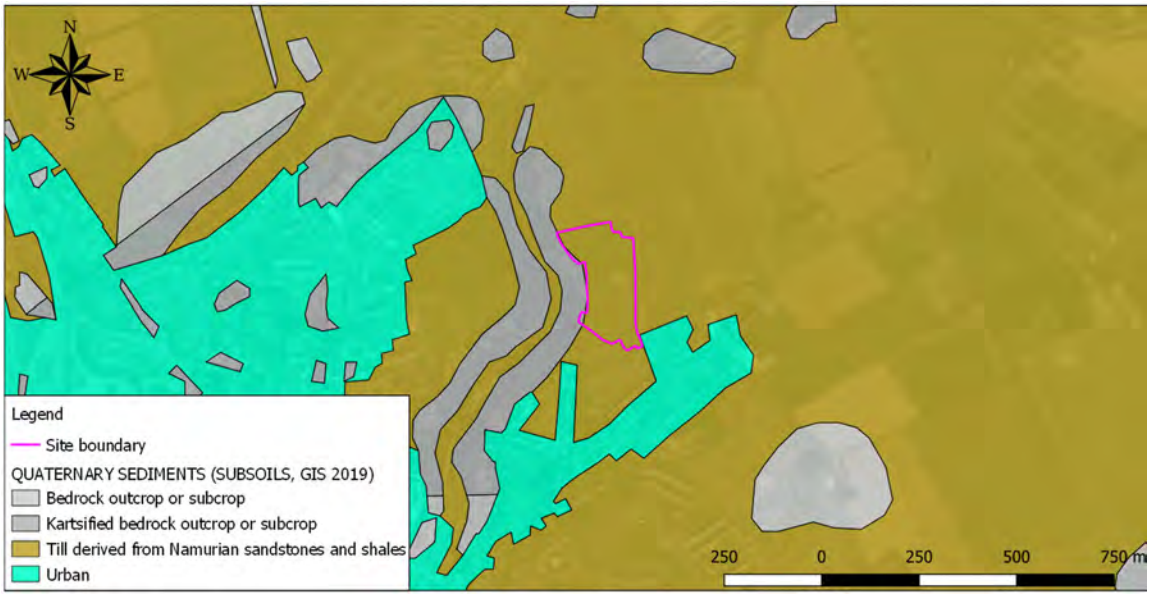

Fig 2.2: The GSI subsoil map (site marked in magenta).

2.2.2 Geology

The GSI 1:100k Bedrock Geology map (GSI, 2018) indicates that the site is underlain by pale-grey massive mud-grade limestone of the Hazelwood Limestone Formation (Fig. 2.3). The Hazelwood Limestone Formation is classified as a "Regionally Important Aquifer - Karstified (diffuse)" (GSIc, 2019).

Fig 2.3: The GSI bedrock map (site marked in magenta).

2.2.3 Groundwater Vulnerability

The groundwater vulnerability at the site (GSIb, 2019) is classified as 'high' to 'extreme' with rock at or near the surface or karst directly to the west of the site (Fig. 2.4).

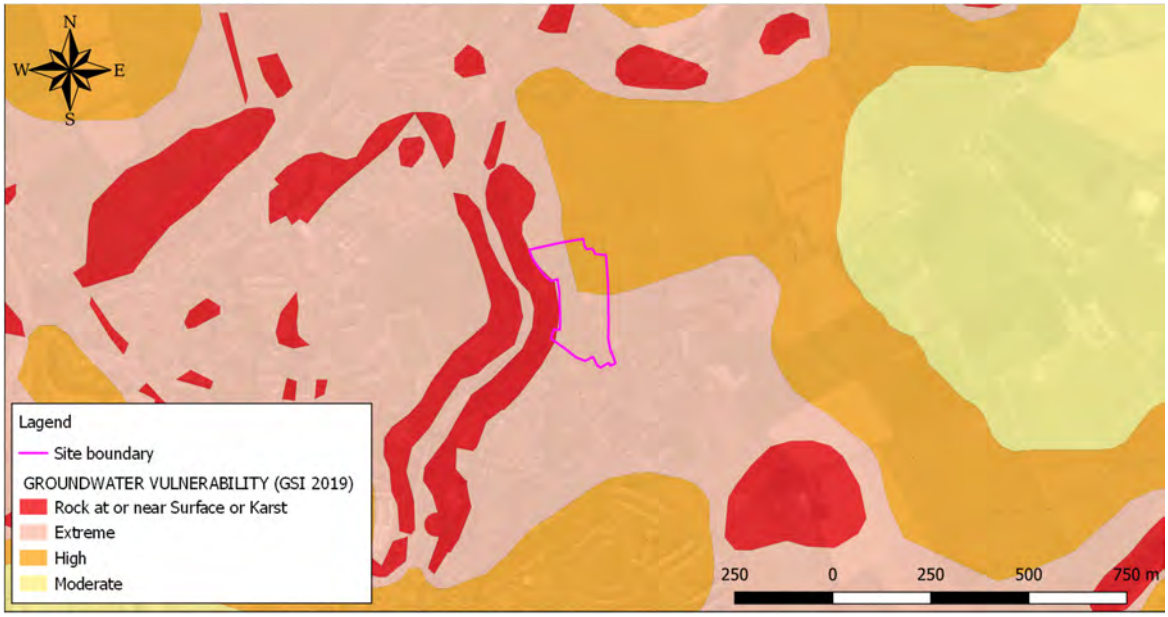

Fig 2.4: The GSI groundwater vulnerability classification map (site marked in magenta).

2.2.4 Historical Data

The historical 6 inch sheet for the area (Fig. 2.5) indicates light grey limestone outcrop in the valley directly northwest of the site and cherty light grey limestones outcrop c. 120 m to the southwest of the site.

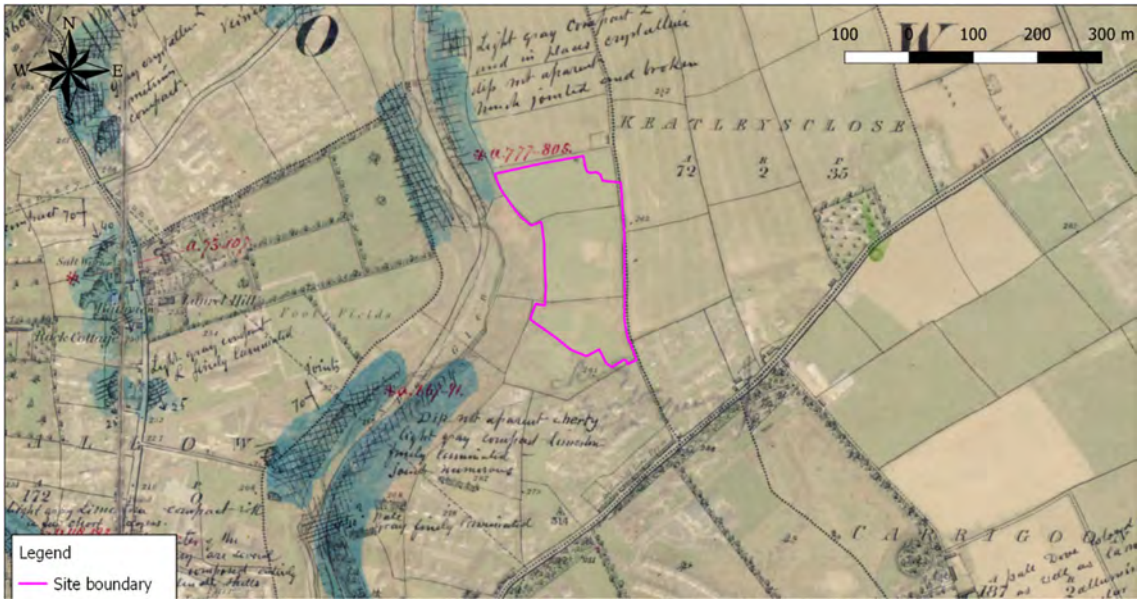

Fig 2.5: The historical 6inch map (site marked in magenta, outcrop marked in blue).

2.3 Survey Rationale

The investigation consisted of reconnaissance EM ground conductivity mapping with follow-up 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling:

EM ground conductivity mapping operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). This technique will provide information on the shallow (0-6m below ground level) variation of the superficial deposits and outline the shallow bedrock.

ERT images the resistivity of the materials in the subsurface along a profile to produce a cross-section showing the variation in resistivity with depth, depending on the length of the profile. Each cross-section is interpreted to determine the material type along the profile at increasing depth, based on the typical resistivities returned for Irish ground materials.

Seismic Refraction profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX A: DETAILED METHODOLOGY**.

3. RESULTS

The survey was carried out on the 22nd and 23rd of February 2023 involving the collection of 767 EM readings, 3 ERT profiles and 10 seismic refraction profiles.

The geophysical survey locations are indicated on Drawing AGP23026_01 (Appendix D).

3.1 EM Ground Conductivity Mapping

EM ground conductivity data was recorded in accessible locations across the site. The EM conductivity results (Drawing AGP23026_02, Appendix D) are indicative of the bulk conductivity of the ground materials from 0-6.0 m bgl. The recorded conductivity values ranged from 1 to 8 mS/m and have been generally interpreted in conjunction with the ERT and seismic data as follows:

Conductivity (mS/m)	Interpretation
1 - 3.25	Predominantly clayey SAND/GRAVEL and/or SAND/GRAVEL in the upper 6 m of soils
3.25 - 5	Predominantly sandy gravelly CLAY in the upper 6 m of soils
5 - 8	Predominantly sandy gravelly CLAY and SILT/CLAY in the upper 6 m of soils

This general interpretation is summarised on Drawing AGP23026_03.

3.2 ERT

Three ERT Profiles (R1 to R3) were recorded across the site (Drawings AGP23026_06 to AGP23026_08). The resistivity values have been generally interpreted as follows:

Resistivity (Ohm-m)	Interpretation
50-100	SILT/CLAY
100-250	Sandy gravelly CLAY
250-500	Clayey SAND/GRAVEL
500-1000	SAND/GRAVEL
250-5000	Limestone

3.3 Seismic Refraction Profiling

Ten seismic refraction spreads (S1-S10) were recorded across the site (Drawings AGP23026_06 to AGP23026_11 and Appendix C). The seismic refraction data indicated 4 velocity layers which have been interpreted as follows:

Layer	Seismic Velocity (m/s)	Average Seismic Velocity (m/s)	Thickness (m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	229-395	284	0.4-2.6 (ave.1.4)	Soil	Soft/Loose	Diggable
2	569-1179	807	2.0-7.8 (ave. 4.4)	Soil	Firm-Stiff/ Medium dense-dense	Diggable
3	1447-2337	1955	1.3-16.3 (ave.10.3)	Soil	Stiff - Very stiff/ Dense-Very dense	
				Moderately Weathered Rock	Poor-Fair	Marginally Ripp. – Break/Blast
4	2555-4802	3879		Slightly Weathered – Fresh Rock	Good	Breaking/ Blasting

It should be noted that the cut-off velocity for excavatability will be lower if excavating in trenches.

3.4 Discussion

The ERT and Seismic Refraction data have been combined to produce the interpreted sections on Drawings AGP23026_06 to AGP23026_11 (Appendix D). The combined results have been summarised as follows:

Layer	Seismic Velocity (m/s)	Average Seismic Velocity (m/s)	Resistivity (Ohm-m)	Interpretation	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	229-395	284	50-100	SILT/CLAY	Soft	Diggable
			100-250	Sandy gravelly SILT/CLAY		
			250-500	Clayey SAND/GRAVEL	Loose	
			500-1000	SAND/GRAVEL		
2	569-1179	807	50-100	SILT/CLAY	Firm-Stiff	Diggable
			100-250	Sandy gravelly SILT/CLAY		
			250-500	Clayey SAND/GRAVEL	Medium dense -Dense	
			500-1000	SAND/GRAVEL		
3	1447-2337	1955	50-100	SILT/CLAY	Stiff-Very Stiff	
			100-250	Sandy gravelly SILT/CLAY		
4	2555-4802	3879	250-5000	Slightly Weathered –Fresh LIMESTONE	Good	Breaking/ Blasting

3.4.1 Soils

The soils have been interpreted as comprising of 3 layers:

1. An upper layer on average 1.4 m thick of soft silt/clay, sandy gravelly silt/clay and/or loose clayey sand/gravel and sand/gravel.
2. Underlain by a layer on average 4.4 m thick of firm to stiff silt/clay, sandy gravelly silt/clay and/or medium dense to dense clayey sand/gravel and sand/gravel.
3. Underlain by a layer on average 10.3 m thick of stiff to very stiff silt/clay and/or sandy gravelly silt/clay.

The interpreted soil thickness is plotted on AGP23026_04 and ranges from 6.1 m in the northwest to 22.3 m thick in the south.

In the absence of ERT data on Drawings AGP23026_09 to _11, the layers from the seismic data have been interpreted based on soil stiffness only. The interpreted soil thickness from these sections have been incorporated into the soil thickness map.

An area with possible buried construction and demolition waste material has been interpreted to the southeast of the site (see Drawing AGP23026_03).

3.4.2 Bedrock

Bedrock has been interpreted as slightly weathered to fresh limestone. The seismic velocities of the bedrock indicate that any excavation will require breaking/blasting. No weathered rock layer has been interpreted from the geophysical data however there may be a thin moderately weathered rock layer at the base of the 3rd soil layer.

The interpreted top of slightly weathered to fresh rock (in mOD) is plotted on Drawing AGP23026_05 at elevations from 51.6 mOD in the northwest to 72.2 mOD in the southeast.

All contour maps include a degree of interpolation, and the data points used to construct the maps are shown on each of the Drawings AGP23026_04 and AGP23026_05.

4. RECOMMENDATIONS

Boreholes are recommended at the following locations to confirm the findings of the geophysical investigation:

No.	Easting ITM	Northing ITM	Interpretation Comment
PBH1	556555.67	599327.64	Zone of thinnest soils
PBH2	556606.24	599299.33	Rock at lowest elevation
PBH3	556672.56	599299.80	Zone of thick soils
PBH4	556652.42	599207.27	
PBH5	556634.00	599145.62	Zone of thick soils
PBH6	556658.45	599093.61	Zone of thick soils
PBH7	556705.58	599084.40	Rock at highest elevation

If any bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, any rotary core drilling, strength testing and trial excavation pits. Trial excavations should be attempted down to formation level using a high-powered excavator of similar rating to that to be used during construction. A more detailed discussion of velocity and excavatability is contained in Appendix B.

The findings of the geophysical investigation should be reviewed following any direct investigation.

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GSIb, 2019;
Groundwater Vulnerability Shapefile. http://www.gsi.ie/Mapping.htm

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APPENDIX A: DETAILED METHODOLOGY

A combination of geophysical techniques was used to provide a high quality interpretation and reduce any ambiguities, which may otherwise exist.

EM Ground Conductivity Mapping

Principles

This is an electromagnetic technique used to investigate lateral variations in overburden material and to assist with the indication of the depth to bedrock. This method operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). Readings over material such as organic waste and peat give high conductivity values while readings over dry materials with low clay mineral content such as gravels, limestone or quartzite give low readings. The EM31 survey technique determines the apparent conductivity of the different overburden layers from 0-6m bgl depending on the dipole mode used.

Data collection

The EM31 equipment used was a GF CMD-4 conductivity meter equipped with data logger. This instrument features a real time graphic display of the previous 20 measurement points to monitor data quality and results. Conductivity and in-phase values were recorded across the site. Local conditions and variations were recorded.

Data processing

The conductivity and in-phase field readings were downloaded, contoured and plotted using the SURFER 12 program (Golden Software, 2015). Data which was affected by metallic objects was removed. Assignation of material types and possible anomaly sources was carried out, with cross-reference to other data.

Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Gradient resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

Profiles were recorded using an ABEM resistivity meter, four 21 takeout multicore cables and up to 81 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.

Data Processing
The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Seismic refraction profiling

Principles
This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

Data Collection
A Geode high resolution 24 channel digital seismograph, 24 x 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (2m spacing). Equipment was carried was operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile.(eg. 46m profile ~15m depth). Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors.

Data Processing
First break picking was carried out using the SeisImager PICKWIN software program (Geometrics) to construct Vp traveltime plots for each profile. The recorded data was processed and interpreted using the ray-tracing and tomographic inversion methods, to acquire depths to boundaries and the Vp velocities of these layers, using the SeisImager PLOTREFA program (Geometrics) which interprets seismic refraction data as a laterally varying layered earth structure.

The program includes three methods for data analysis; tomographic inversion, time-term inversion and reciprocal methods. The tomographic inversion method creates an initial velocity model, then traces rays through the model, comparing the calculated and measured traveltimes. The model is then modified, and the process repeated to minimise the difference between the calculated and measured times. The time-term method determines refractor boundaries. The data was processed using both the tomographic and time-term inversion methods. Topographic data were input. Material types were assigned and estimation made of material properties, cross-referenced to ERT data.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

Spatial Relocation

All the geophysical investigation and thermal resistivity locations were acquired using Trimble Geo 7X high-accuracy GNSS handheld GPS system using the settings listed below. This system allows collecting GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Metres
Altitude units:	Metres
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

The EM conductivity locations were acquired using a system integrated GPS receiver to an x,y accuracy of +/- 5m or better and converted to ITM.

APPENDIX B: EXCAVATABILITY

The seismic velocity of a rock formation is related to characteristics of the rock mass which include rock hardness and strength, degree of weathering and discontinuities. Usually the velocity is just one of several parameters used in the assessment of excavatability. The excavatability of a rock formation is favoured by the following factors:

- Open fractures, faults and other planes of weakness of any kind
- Weathering
- Brittleness and crystalline nature
- High degree of stratification or lamination
- Large grain size
- Low compressive strength

Weaver (1975) presented a comprehensive rippability rating chart (Fig.1) in which the p-wave velocity value and the relevant geological factors could be entered and assigned appropriate weightings. The total weighted index was found to correlate very well with actual rippability.

Fig.1 Rippability Rating Chart

Rock class	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock
Seismic velocity (m/s)	>2150	2150-1850	1850-1500	1500-1200	1200-450
Rating	26	24	20	12	5
Rock hardness	Extremely hard rock	Very hard rock	Hard rock	Soft rock	Very soft rock
Rating	10	5	2	1	0
Rock weathering	Unweathered	Slightly weathered	Weathered	Highly weathered	Completely weathered
Rating	9	7	5	3	1
Joint spacing (mm)	>3000	3000-1000	1000-300	300-50	<50
Rating	30	25	20	10	5
Joint continuity	Non continuous	Slightly continuous	Continuous-no gouge	Continuous-some gouge	Continuous-with gouge
Rating	5	5	3	0	0
Joint gouge	No separation	Slight separation	Separation <1mm	Gouge <5mm	Gouge >5mm
Rating	5	5	4	3	1
Strike and dip orientation	Very unfavourable	Unfavourable	Slightly unfavourable	Favourable	Very favourable
Rating	15	13	10	5	3
Total rating	100-90	90-70*	70-50	50-25	<25
Rippability assessment	Blasting	Extremely hard ripping and blasting	Very hard ripping	Hard ripping	Easy ripping
Tractor horsepower		770/385	385/270	270/180	180
Tractor kilowatts		575/290	290/200	200/135	135

APPENDIX C: SEISMIC DATA

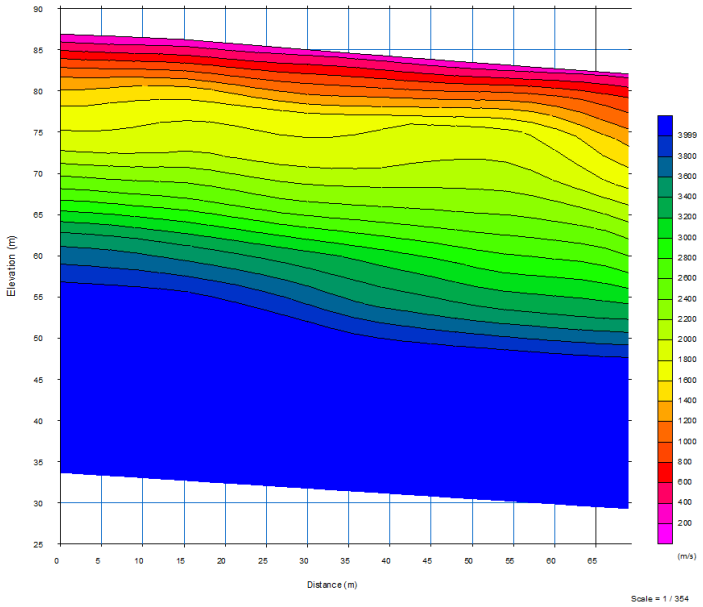


Fig. C1.1: Seismic refraction S1 (from SE to NW)

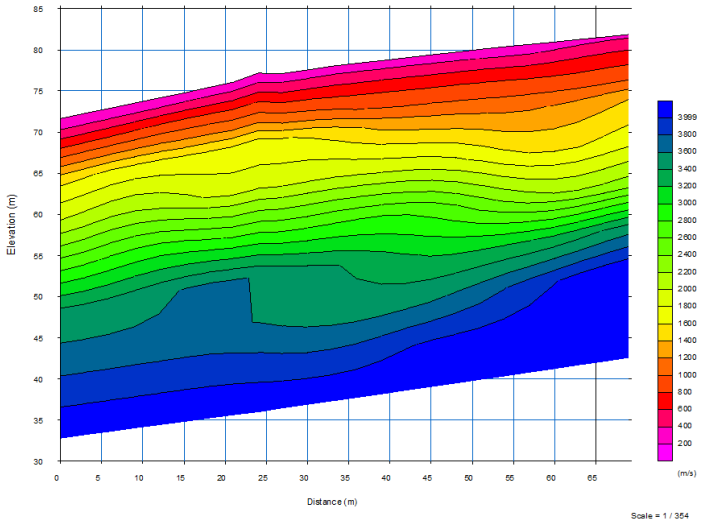


Fig. C1.2: Seismic refraction S2 (from NW to SE)

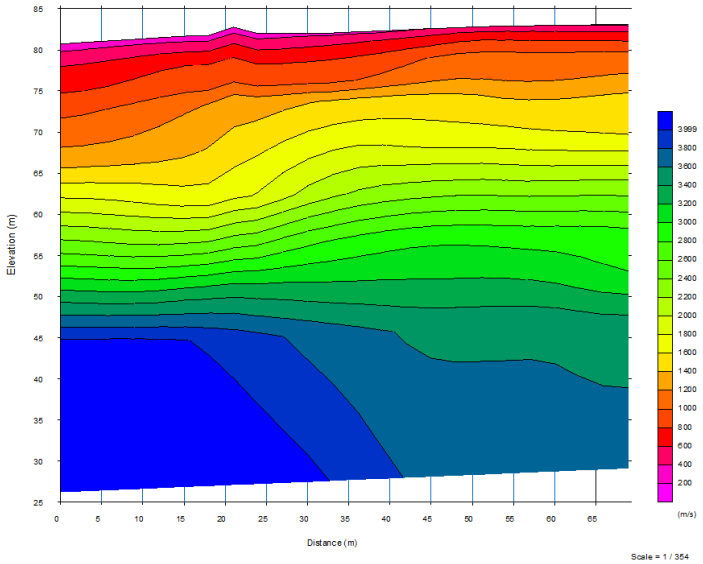


Fig. C1.3: Seismic refraction S3 (from NW to SE)

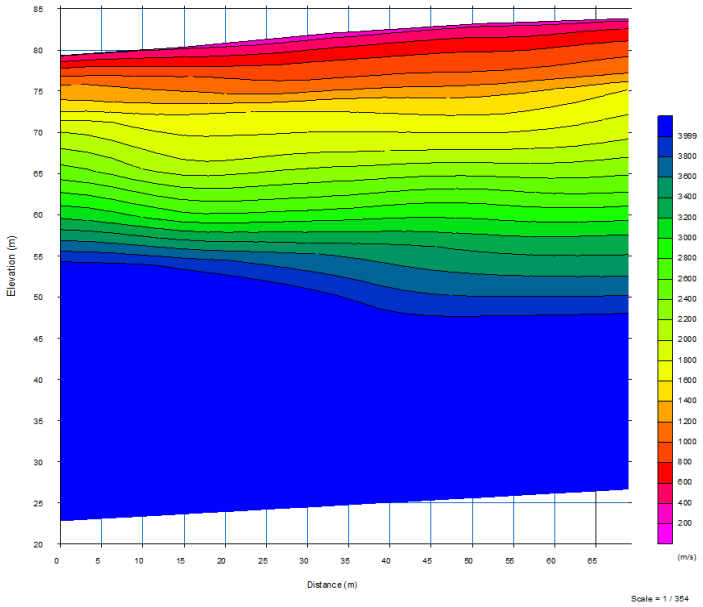


Fig. C1.4: Seismic refraction S4 (from N to S)

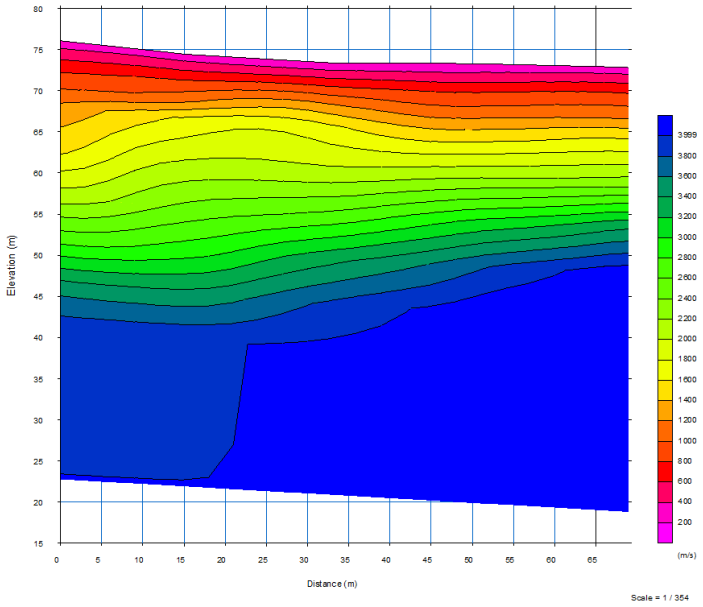


Fig. C1.5: Seismic refraction S5 (from SSE to NNW)

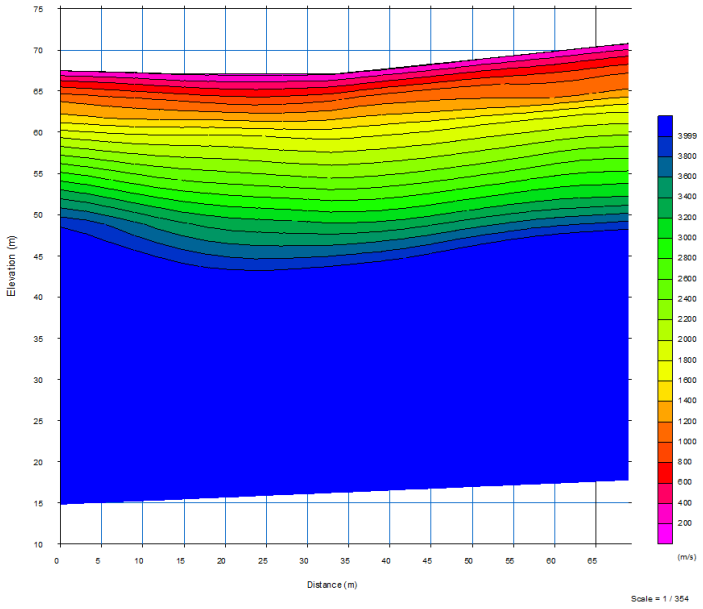


Fig. C1.6: Seismic refraction S6 (from NNW to SSE)

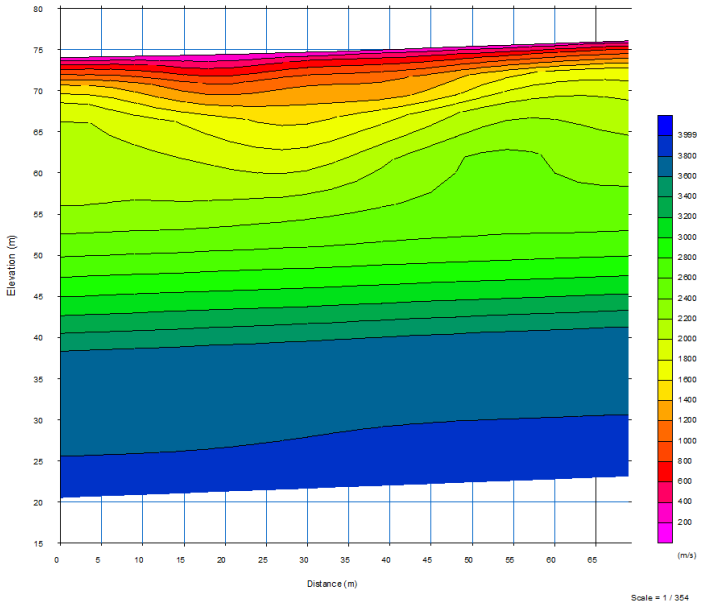


Fig. C1.7: Seismic refraction S7 (from N to S)

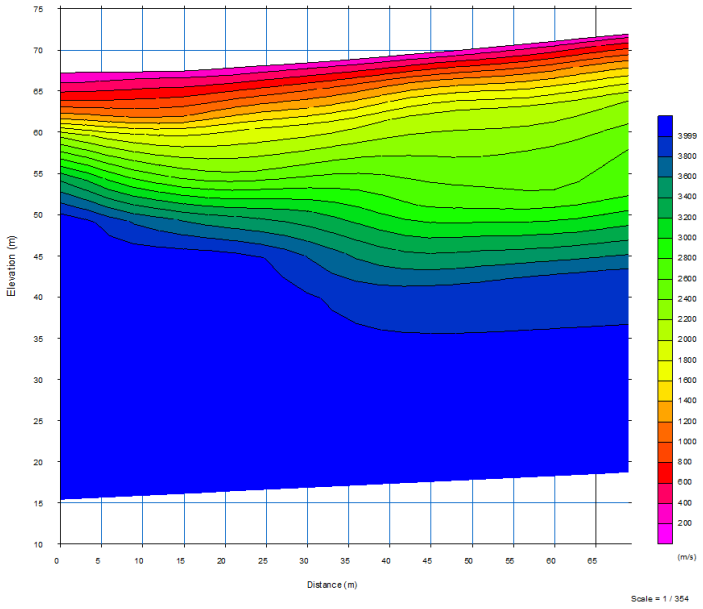


Fig. C1.8: Seismic refraction S8 (from WSW to ENE)

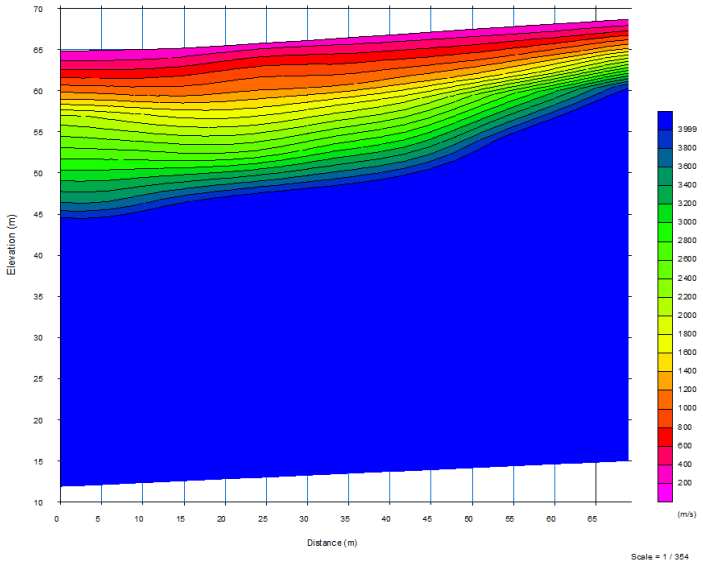


Fig. C1.9: Seismic refraction S9 (from SE to NW)

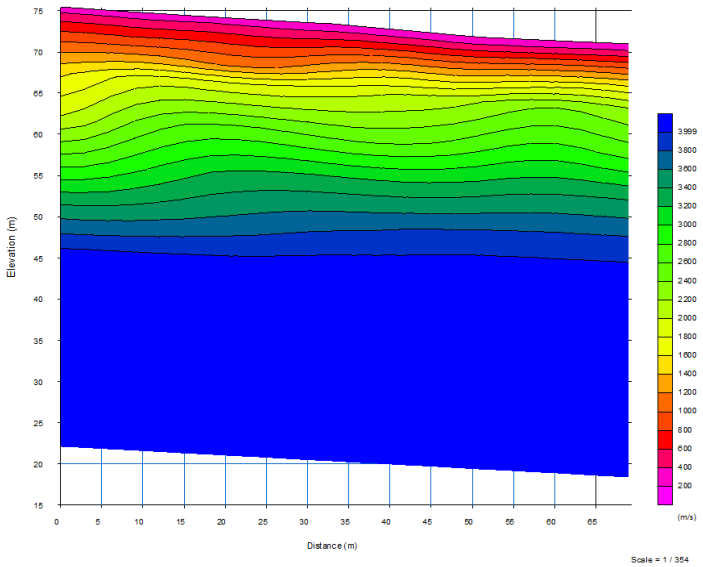


Fig. C1.10: Seismic refraction S10 (from SSE to NNW)

APPENDIX D: DRAWINGS

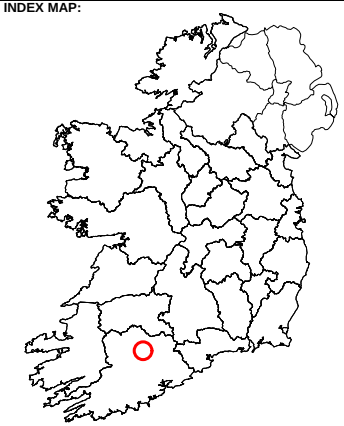
The information derived from the geophysical investigation is presented in the following drawings:

AGP23026_01	Geophysical Survey Locations	1:2000	@ A4
AGP23026_02	EM Ground Conductivity Contours (mS/m)	1:2000	@ A4
AGP23026_03	Summary Interpretation Map	1:2000	@ A4
AGP23026_04	Interpreted Soil Thickness (m)	1:2000	@ A4
AGP23026_05	Interpreted Rock Elevation (mOD)	1:2000	@ A4
AGP23026_06	Results and Interpretation- ERT R1, S5 & S6	1:1500	@ A4
AGP23026_07	Results and Interpretation- ERT R2, S3 & S10	1:1500	@ A4
AGP23026_08	Results and Interpretation- ERT R3, S4 & S7	1:1500	@ A4
AGP23026_09	Results and Interpretation- S1 & S2	1:1000	@ A4
AGP23026_10	Results and Interpretation- S8	1:1000	@ A4
AGP23026_11	Results and Interpretation- S9	1:1000	@ A4

GEOPHYSICAL SURVEY LOCATIONS

SCALE 1:2000

INDEX MAP:



LEGEND:

- Site
- EM conductivity reading
- R1 — 2D resistivity profile
- S1 — Seismic refraction profile

The information displayed here is to be used in conjunction with AGP23026_01 Report on the Geophysical Investigation at St. Joseph's Road, Mallow, Co. Cork for Walsh Design Group, APEX Geophysics Ltd. 21st April 2023

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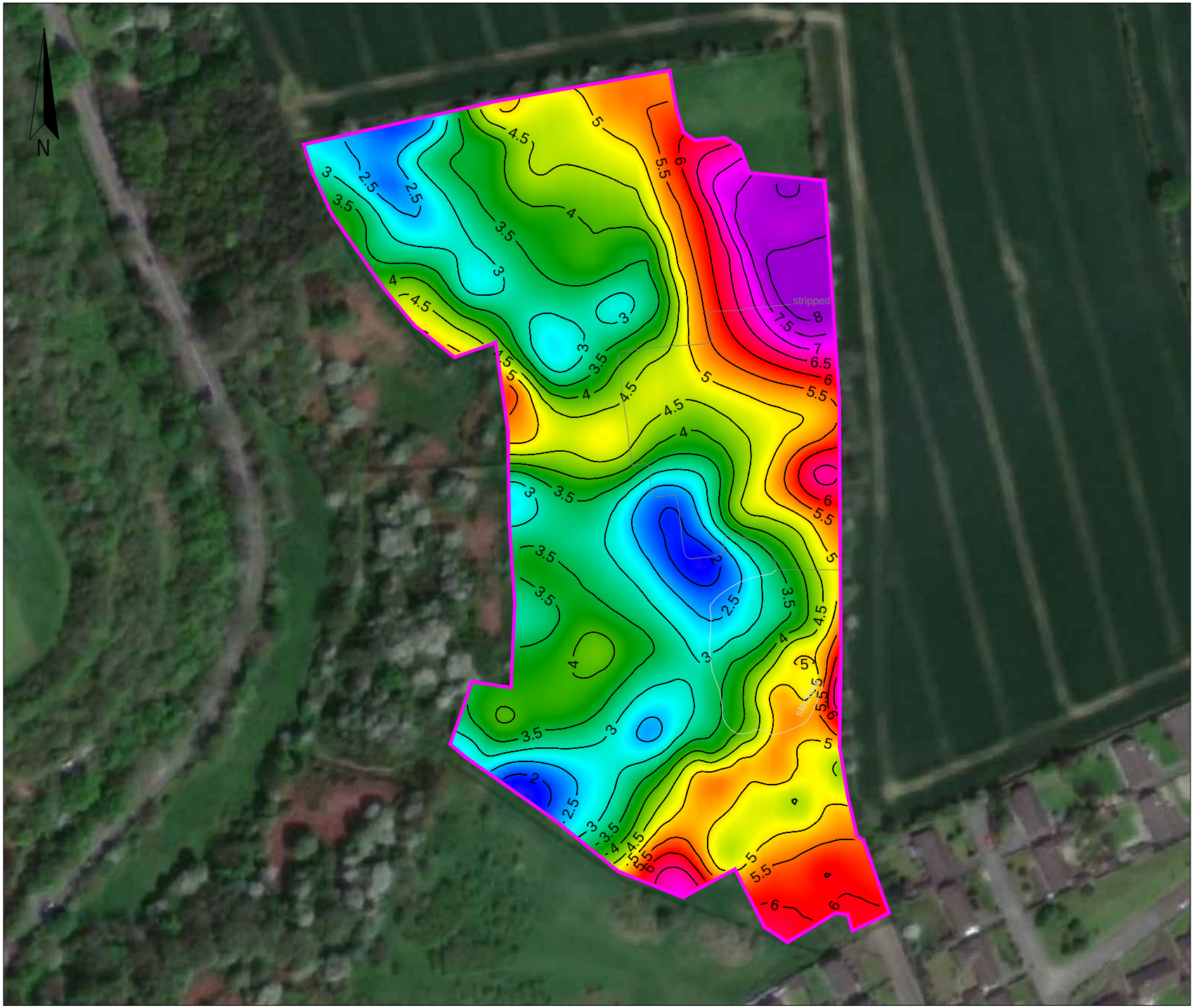
PROJECT:	ST.JOSEPH'S ROAD GEOPHYSICAL INVESTIGATION
CLIENT:	WALSH DESIGN/CORK COUNTY COUNCIL
DRAWING NO:	AGP23026_01
SCALE:	AS INDICATED @ A4
DATE:	21-04-2023

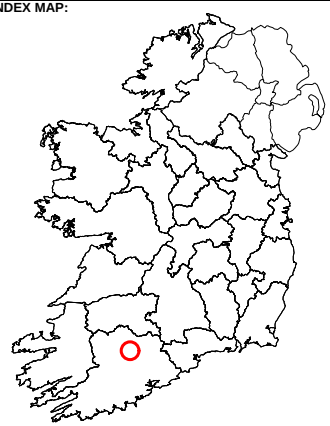
Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

EM GROUND CONDUCTIVITY CONTOURS (mS/m)

SCALE 1:2000



INDEX MAP:



LEGEND:

Site

Conductivity (mS/m)

1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8

The information displayed here is to be used in conjunction with AGP23026_01 Report on the Geophysical Investigation at St. Joseph's Road, Mallow, Co. Cork for Walsh Design Group, APEX Geophysics Ltd. 21st April 2023

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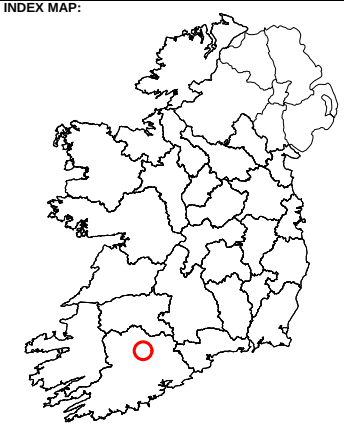
PROJECT:	ST.JOSEPH'S ROAD GEOPHYSICAL INVESTIGATION
CLIENT:	WALSH DESIGN/CORK COUNTY COUNCIL
DRAWING NO:	AGP23026_02
SCALE:	AS INDICATED @ A4
DATE:	21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

SUMMARY INTERPRETATION MAP

SCALE 1:2000

INDEX MAP:



LEGEND:

- Site
- Predominantly clayey SAND/GRAVEL and/or SAND/GRAVEL in the upper 6 m of soils
- Predominantly sandy gravelly CLAY in the upper 6 m of soils
- Predominantly sandy gravelly CLAY and SILT/CLAY in the upper 6 m of soils
- Possible C & D waste present
- PBH1 Proposed borehole

The information displayed here is to be used in conjunction with AGP23026_01 Report on the Geophysical Investigation at St. Joseph's Road, Mallow, Co. Cork for Walsh Design Group, APEX Geophysics Ltd. 21st April 2023

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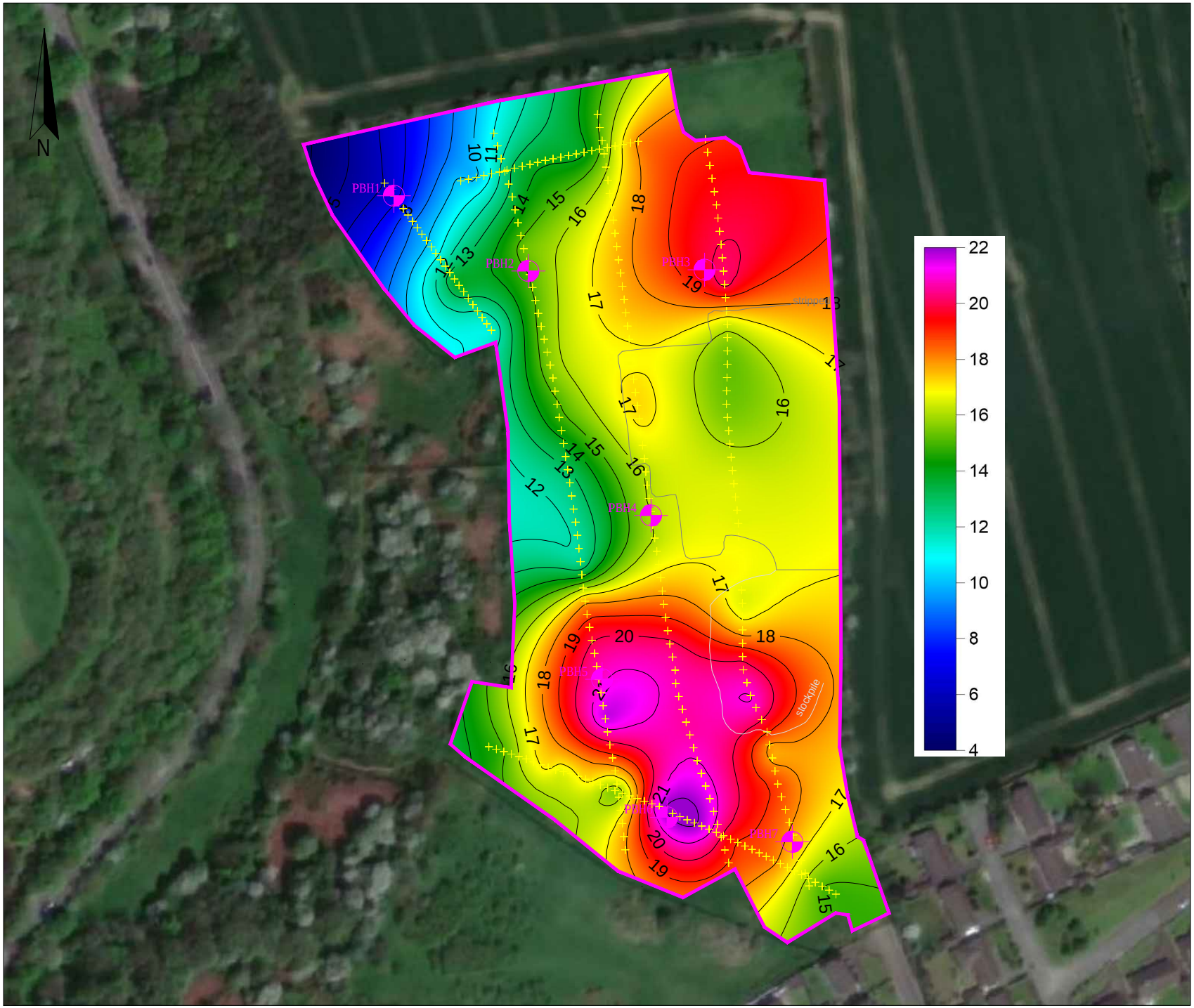
PROJECT:	ST.JOSEPH'S ROAD GEOPHYSICAL INVESTIGATION
CLIENT:	WALSH DESIGN/CORK COUNTY COUNCIL
DRAWING NO:	AGP23026_03
SCALE:	AS INDICATED @ A4
DATE:	21-04-2023

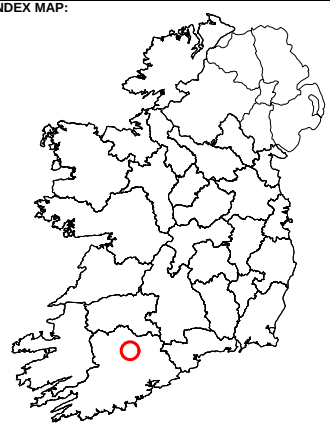
Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

INTERPRETED SOIL THICKNESS (m)

SCALE 1:2000



INDEX MAP:



LEGEND:

Site

Data point

Overburden thickness (m)

PBH1 Proposed borehole

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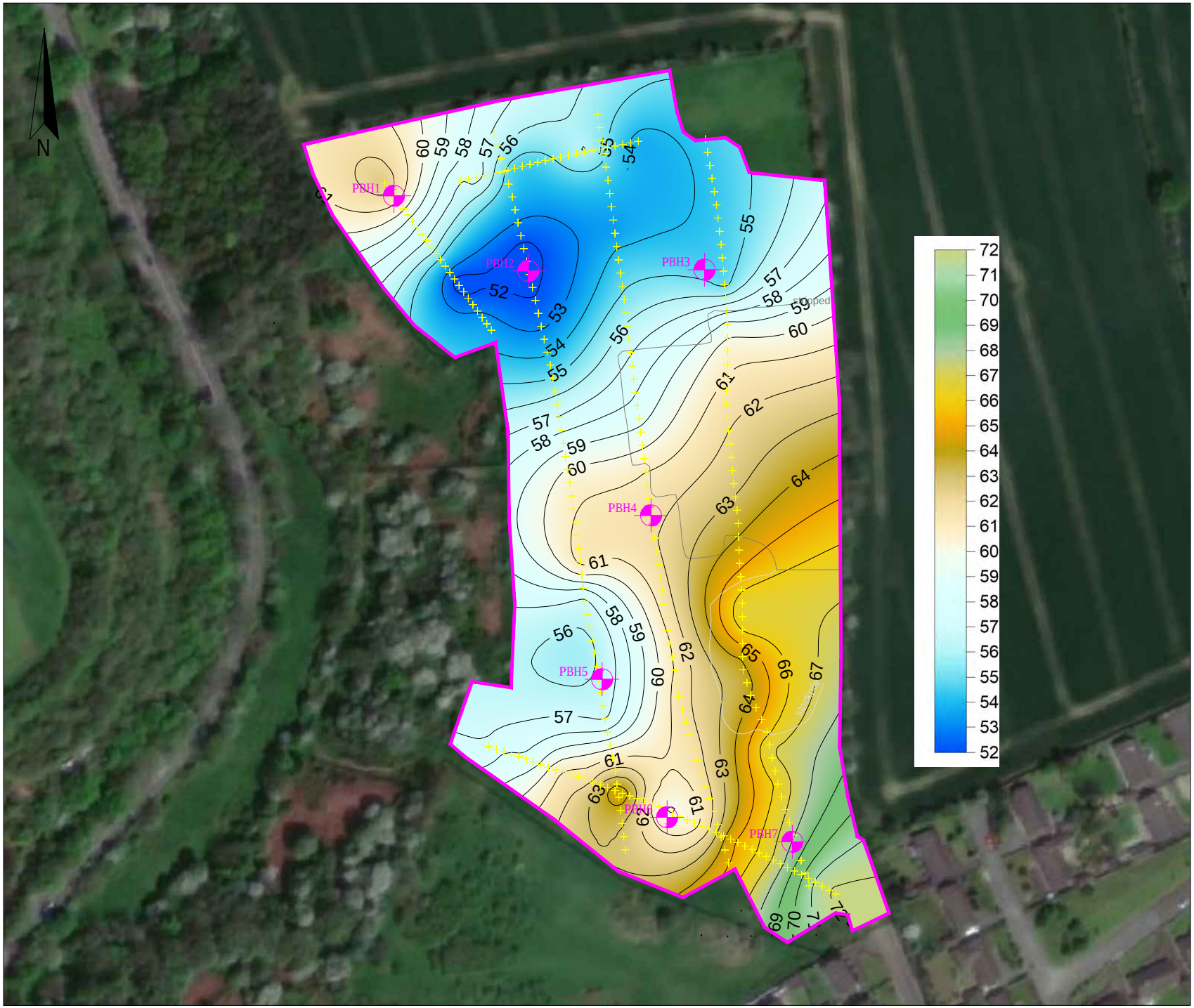
PROJECT:	ST.JOSEPH'S ROAD GEOPHYSICAL INVESTIGATION
CLIENT:	WALSH DESIGN/CORK COUNTY COUNCIL
DRAWING NO:	AGP23026_04
SCALE:	AS INDICATED @ A4
DATE:	21-04-2023

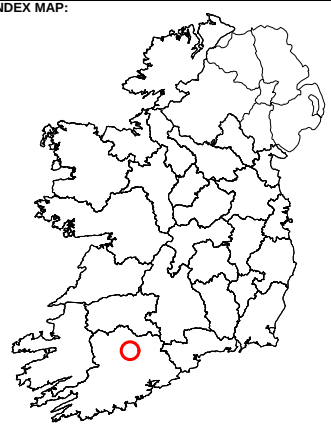
Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

INTERPRETED ROCK ELEVATION (mOD)

SCALE 1:2000



INDEX MAP:



LEGEND:

Site

Data point

Top of bedrock elevation (mOD)

PBH1 Proposed borehole

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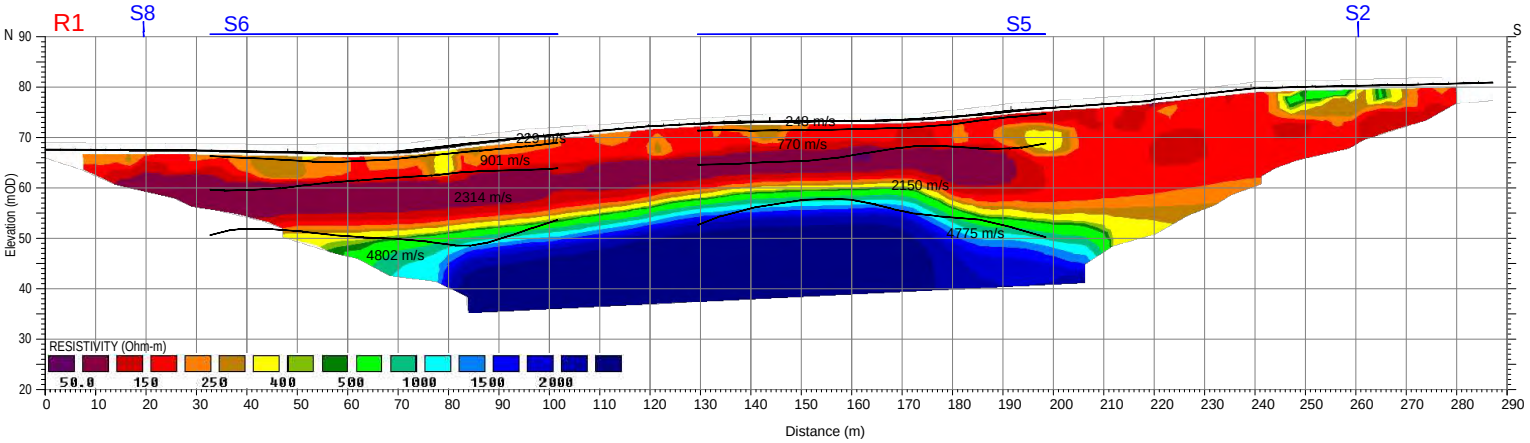
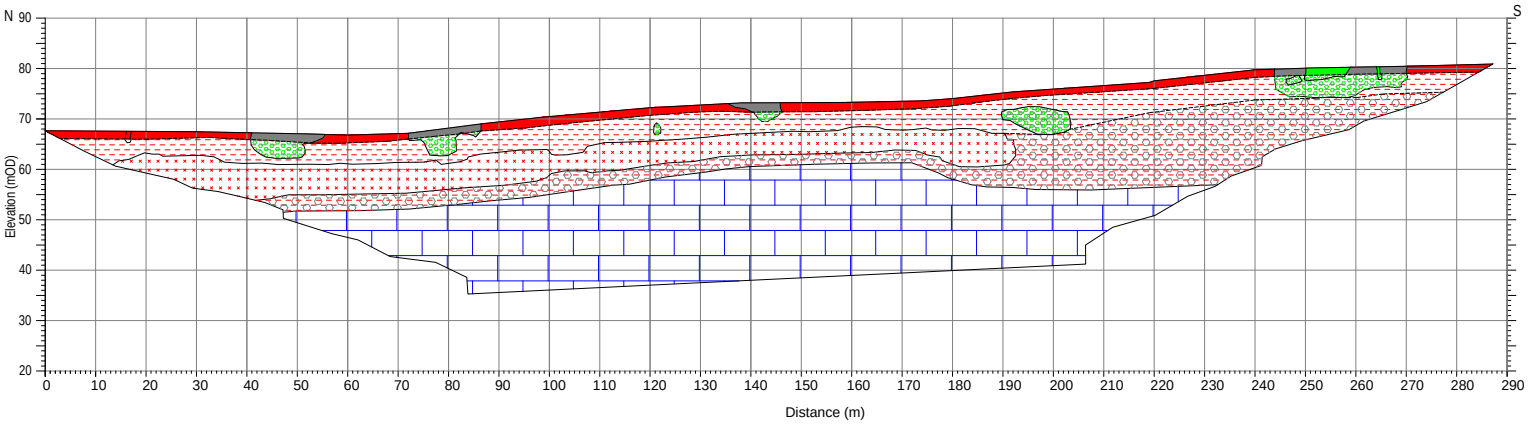
PROJECT:	ST.JOSEPH'S ROAD GEOPHYSICAL INVESTIGATION
CLIENT:	WALSH DESIGN/CORK COUNTY COUNCIL
DRAWING NO:	AGP23026_05
SCALE:	AS INDICATED @ A4
DATE:	21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

RESULTS AND INTERPRETATION - ERT R1, S5 & S6

SCALE 1:1500





LEGEND:

- Soft SILT/CLAY
- Firm-Stiff SILT/CLAY
- Stiff-Very Stiff SILT/CLAY
- Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Stiff-Very Stiff Sandy gravelly SILT/CLAY
- Loose clayey SAND/GRAVEL
- Med. Dense-Dense clayey SAND/GRAVEL
- Loose SAND/GRAVEL
- Med. Dense-Dense SAND/GRAVEL
- Slightly Weathered-Fresh LIMESTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

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PROJECT: ST.JOSEPH'S ROAD GEOPHYSICAL SURVEY

CLIENT.: WALSH DESIGN/CORK COUNTY COUNCIL

DRAWING NO: AGP23026_06

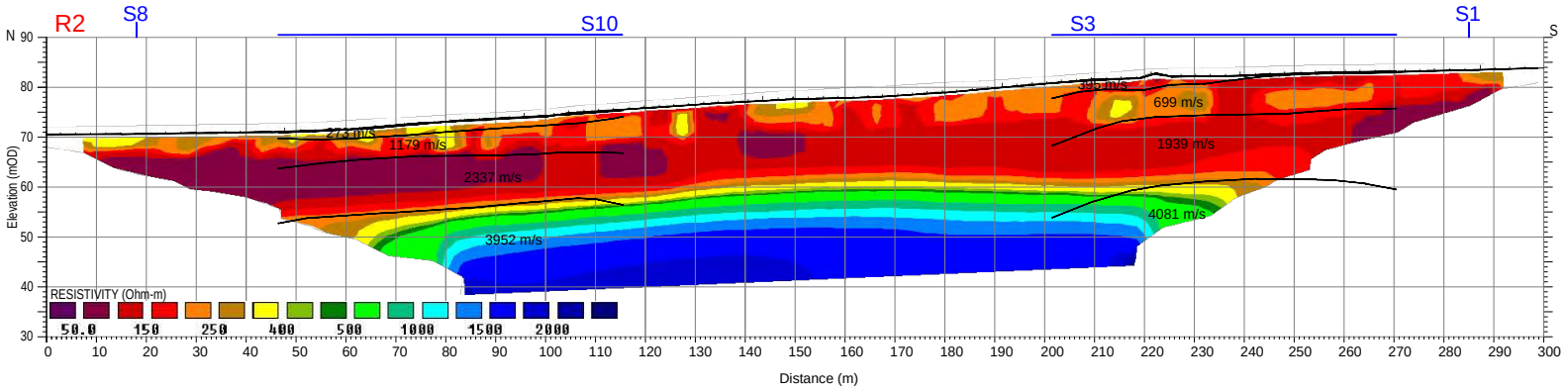
SCALE: AS INDICATED @ A4

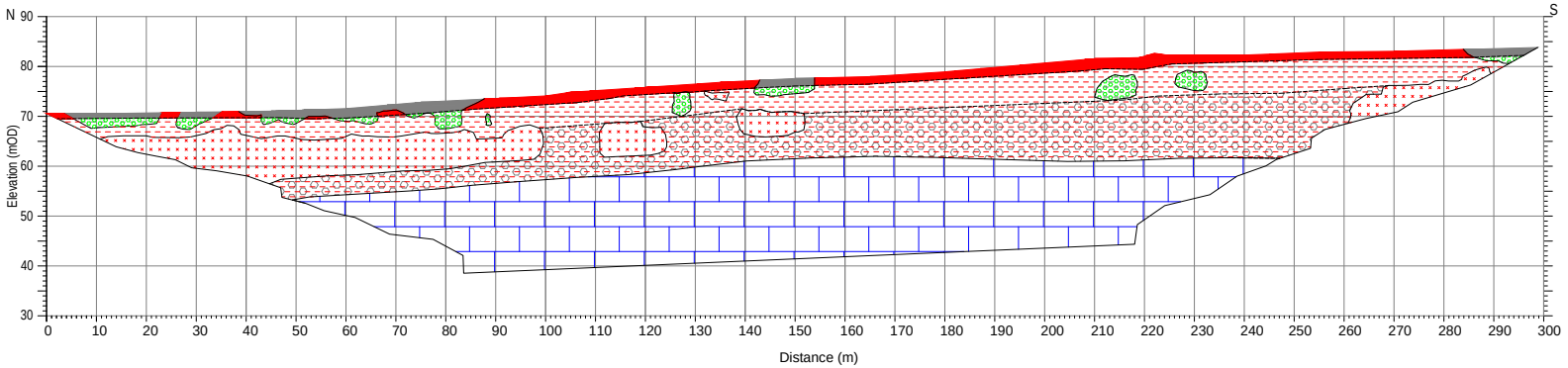
DATE: 21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

RESULTS AND INTERPRETATION - ERT R2, S3 & S10

SCALE 1:1500





LEGEND:

- Soft SILT/CLAY
- Firm-Stiff SILT/CLAY
- Stiff-Very Stiff SILT/CLAY
- Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Stiff-Very Stiff Sandy gravelly SILT/CLAY
- Loose clayey SAND/GRAVEL
- Med. Dense-Dense clayey SAND/GRAVEL
- Loose SAND/GRAVEL
- Med. Dense-Dense SAND/GRAVEL
- Slightly Weathered-Fresh LIMESTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

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PROJECT: ST.JOSEPH'S ROAD GEOPHYSICAL SURVEY

CLIENT.: WALSH DESIGN/CORK COUNTY COUNCIL

DRAWING NO: AGP23026_07

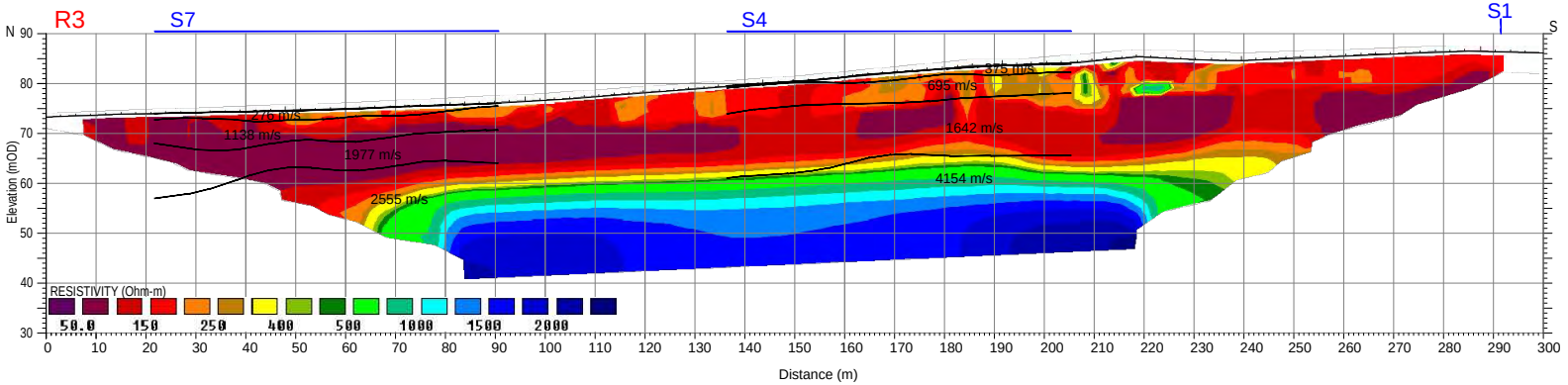
SCALE: AS INDICATED @ A4

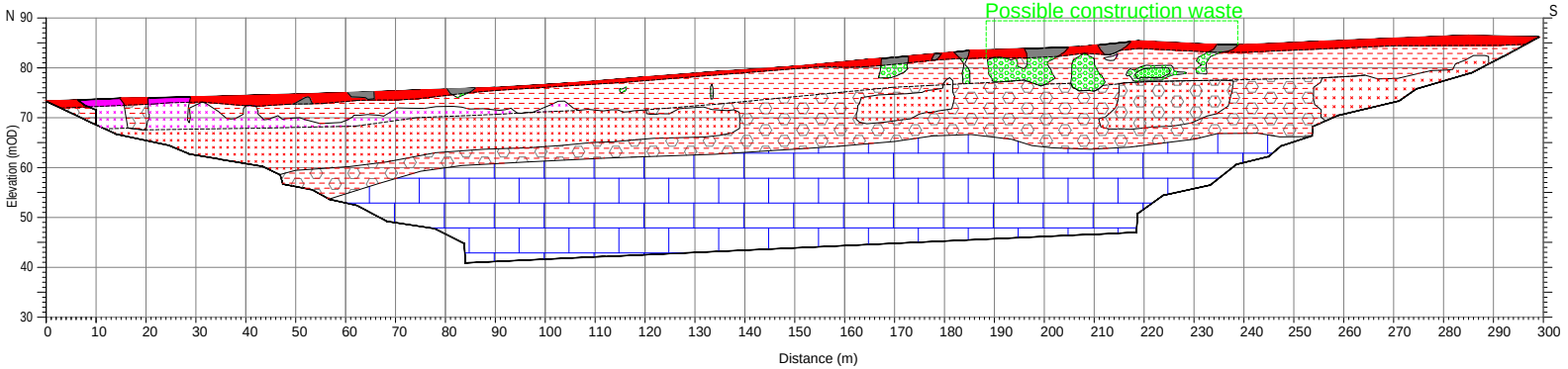
DATE: 21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

RESULTS AND INTERPRETATION - ERT R3, S4 & S7

SCALE 1:1500





LEGEND:

- Soft SILT/CLAY
- Firm-Stiff SILT/CLAY
- Stiff-Very Stiff SILT/CLAY
- Soft sandy gravelly SILT/CLAY
- Firm-Stiff sandy gravelly SILT/CLAY
- Stiff-Very Stiff Sandy gravelly SILT/CLAY
- Loose clayey SAND/GRAVEL
- Med. Dense-Dense clayey SAND/GRAVEL
- Loose SAND/GRAVEL
- Med. Dense-Dense SAND/GRAVEL
- Slightly Weathered-Fresh LIMESTONE
- 1254-1288 m/s Seismic refraction layer with interpreted P-wave velocity

The information displayed here is to be used in conjunction with AGP23026_01 Report on the Geophysical Investigation at St. Joseph's Road, Mallow, Co. Cork for Walsh Design Group, APEX Geophysics Ltd. 21st April 2023

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PROJECT: ST.JOSEPH'S ROAD GEOPHYSICAL SURVEY

CLIENT.: WALSH DESIGN/CORK COUNTY COUNCIL

DRAWING NO: AGP23026_08

SCALE: AS INDICATED @ A4

DATE: 21-04-2023

Version:	Date:	Drawn By:	Checked:
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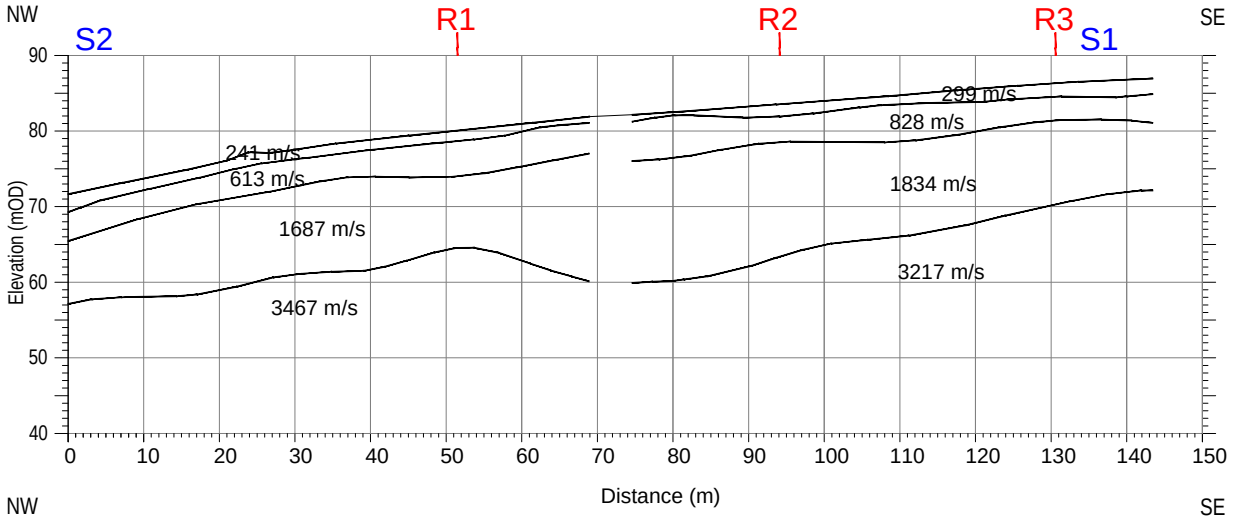
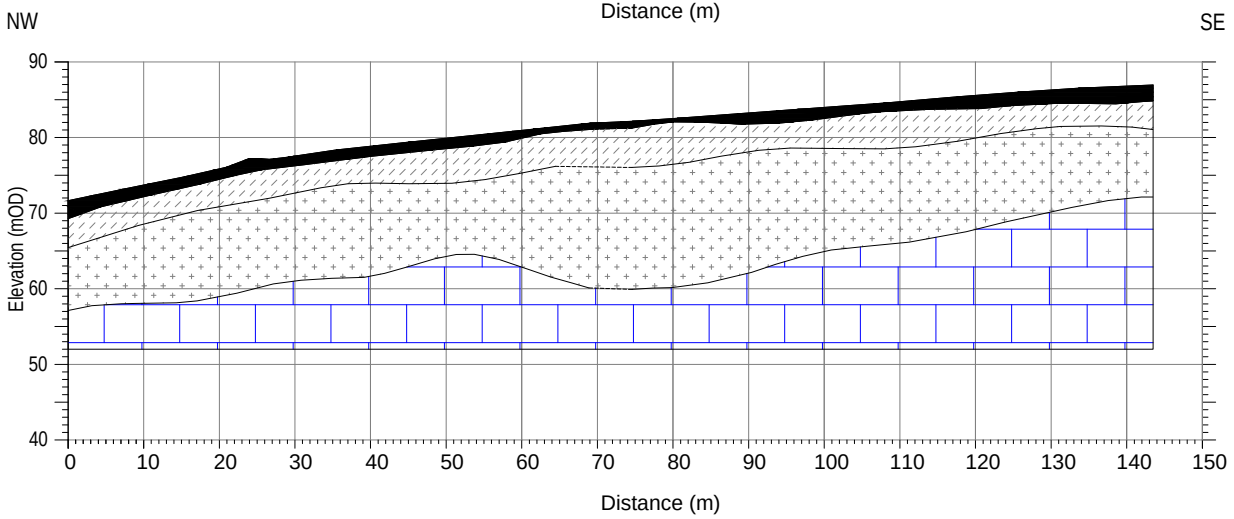
RESULTS AND INTERPRETATION - S1 & S2

SCALE 1:1000





LEGEND:

- Soft/Loose SOIL
- Firm-Stiff/Medium dense-Dense SOIL
- Stiff-Very Stiff SOIL
- Slightly Weathered-Fresh LIMESTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

The information displayed here is to be used in conjunction with AGP23026_01 Report on the Geophysical Investigation at St. Joseph's Road, Mallow, Co. Cork for Walsh Design Group, APEX Geophysics Ltd. 21st April 2023

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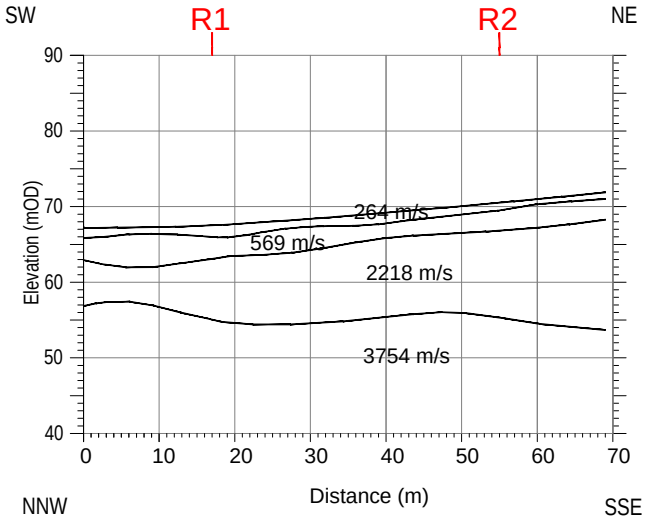
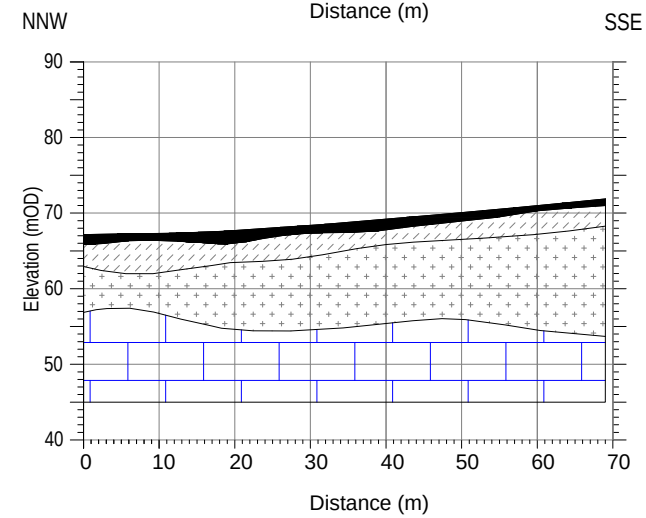
PROJECT:	ST.JOSEPH'S ROAD GEOPHYSICAL SURVEY
CLIENT.:	WALSH DESIGN/CORK COUNTY COUNCIL
DRAWING NO:	AGP23026_09
SCALE:	AS INDICATED @ A4
DATE:	21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

RESULTS AND INTERPRETATION - S8

SCALE 1:1000





LEGEND:

- Soft/Loose SOIL
- Firm-Stiff/Medium dense-Dense SOIL
- Stiff-Very Stiff SOIL
- Slightly Weathered-Fresh LIMESTONE
- 1254-1288 m/s — Seismic refraction layer with interpreted P-wave velocity

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PROJECT: ST.JOSEPH'S ROAD GEOPHYSICAL SURVEY

CLIENT.: WALSH DESIGN/CORK COUNTY COUNCIL

DRAWING NO: AGP23026_10

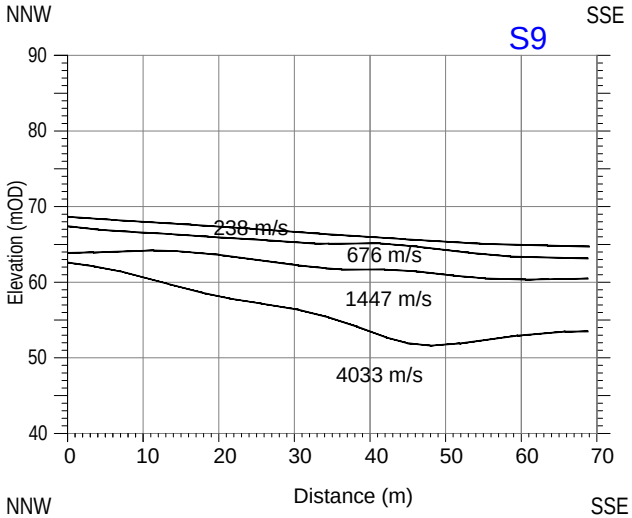
SCALE: AS INDICATED @ A4

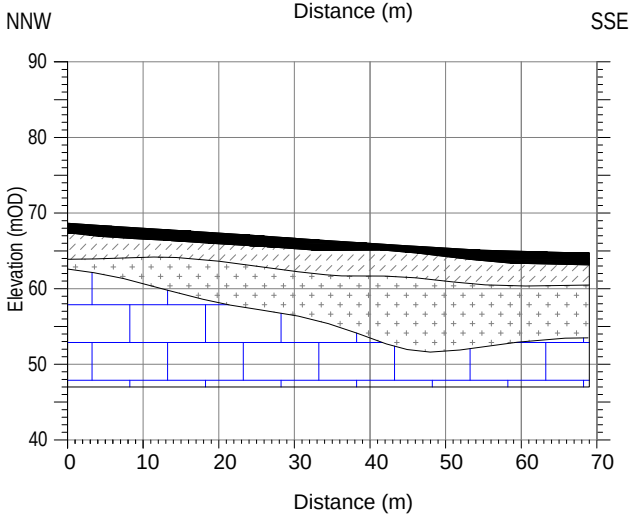
DATE: 21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL

RESULTS AND INTERPRETATION - S9

SCALE 1:1000





INDEX MAP:

LEGEND:

- Soft/Loose SOIL
- Firm-Stiff/Medium dense-Dense SOIL
- Stiff-Very Stiff SOIL
- Slightly Weathered-Fresh LIMESTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

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PROJECT: ST.JOSEPH'S ROAD GEOPHYSICAL SURVEY

CLIENT.: WALSH DESIGN/CORK COUNTY COUNCIL

DRAWING NO: AGP23026_11

SCALE: AS INDICATED @ A4

DATE: 21-04-2023

Version:	Date:	Drawn By:	Checked:
01	21-04-2023	YOC	TL