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AFRY

Construction and Environmental Management Plan Proposed Strategic Infrastructure Development of 110kV Substation, and Grid Connection, Ballinrea, Co. Cork

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This document has been prepared by

…….

Kingsley Slippe
AFRY Ireland Limited

This document has been checked by

…….

Liam Power
AFRY Ireland Limited

This document has been approved by

…….

Brendan Heneghan
AFRY Ireland Limited

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1. INTRODUCTION

Afry Ireland was retained by Ballinrea Solar Farm Ltd (a subsidiary of Ørsted Onshore Ireland Midco Limited), to prepare this Construction and Environmental Management Plan (CEMP) for a 110kV Substation, 110kV tail fed underground electricity interconnection cabling and associated ancillary works connecting the Solar Photovoltaic (PV) Energy Developments at both permitted Ballinrea and Ballinvuskig Solar Farms respectively.

This Construction and Environmental Management Plan (CEMP) has been updated from the version which was developed by MKO on behalf of Ballinrea Solar Farm Ltd (a subsidiary of Ørsted Onshore Ireland Midco Limited), who successfully applied to An Bord Pleanála under Pl Ref: ABP-317706-23 for permission for a Strategic Infrastructure Development (SID) at Ballinrea and adjacent townlands, Co. Cork. The Proposed Development will be comprised of a 110kV substation at the permitted Ballinrea Solar farm (Pl Ref: 17/6784, ABP Ref: PL04.30313, as modified by 23/4564, ABP Ref. 318915), a tail fed underground grid connection from the proposed 110kV substation to the existing Raffeen 220kV substation, a proposed new 110kV cable bay at the existing Raffeen 220kV and associated works.

The permitted development (Pl Ref: ABP-317706-23) is intended to connect the permitted Solar Farm at Ballinrea (Pl. Ref.17/6784, ABP Ref. 303013) and the associated permitted solar farm at Ballinvuskig (Pl. Ref. 19/5371, ABP Ref. 305186, as modified by 23/41837, ABP Ref. 318925) to the national grid.

It should be noted that this Construction Environmental Management Plan (CEMP), addresses all the proposed works associated with the grid connection and 110kV substation scope of works only and is made in accordance with the planning conditions under Pl Ref: ABP-317706-23. The other elements of the permitted Ballinrea solar farm (permitted under 17/6784, ABP Ref: PL04.30313, as modified by 23/4564, ABP Ref.318915) will be dealt with under a separate CEMP submitted to Cork County Council as part of the Ballinrea Solar Farm Planning Compliance.

This report provides the environmental management framework to be adhered to during the pre-commencement and construction phase of the permitted development and it incorporates the mitigating principles to ensure that the work is conducted in a way that minimises the potential for any environmental impacts to occur. This report has been prepared in accordance with the mitigation measures and commitments made in the approved application for the development.

This CEMP identifies for the incoming Contractor, the key planning and environmental considerations that must be adhered to and delivered during site construction. This report is intended as a single, amalgamated document that can be used during the future phases of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer and contractors alike.

1.1. Objective & Purpose

The CEMP will require further updating by the selected contractor and final agreement with the various stakeholders prior to construction commencing, in line with all conditions which apply and to identify, assess and satisfy the contract performance criteria. Therefore, this is a working document and will be developed further prior to construction commencing.

Triggers for amendments to the CEMP will include:

- When there is a need to improve performance to ensure there is no environmental Impact.
- As a result of changes in environmental legislation applicable and relevant to the project.
- Where the outcomes from auditing establish a need for change.
- Where Work Method Statements identify changes to a construction methodology to address high environmental risk; and

- As a result of an incident or complaint occurring that necessitates an amendment.

1.2. Scope of Construction and Environmental Management Plan

This report is presented as a guidance document for the construction phase of the proposed 110kV substation and associated grid route connection to the permitted but not yet constructed solar farm in Ballinrea, Co. Cork. Where the term 'site' is used in the CEMP, it refers to all works associated with the substation, 110kV grid route and associated enabling works. The CEMP outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner. The report is divided into nine sections, as outlined below.

- **Section 1** Provides a brief introduction as to the scope of the report.
- **Section 2** Outlines the Site and Project details, detailing the targets and objectives of this plan along with providing an overview of construction methodologies that will be adopted throughout the proposed project. It also contains a list of the planning conditions that need to be adhered to as part of the planning approval.
- **Section 3** Sets out details of the environmental controls on site which looks at noise and dust controls. Site drainage and a waste management plan are also included in this section.
- **Section 4** Sets out a fully detailed implementation plan for the environmental management of the proposed project outlining the roles and responsibilities of the project team
- **Section 5** Outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection
- **Section 6** Consists of a summary table of all mitigation proposals to be adhered to during the implementation of the proposed project.
- **Section 7** Sets out a programme for the timing of the proposed works.
- **Section 8** Outlines the proposals for reviewing compliance with the provisions of this report.

1.3. Targets and Objectives

The construction phase works are designed to approved standards, which include specified materials, standards, specifications and codes of practice. The design of the project has considered environmental issues, and this is enhanced by the works proposals.

The key site targets are as follows;

- Ensure construction works and activities are completed in accordance with mitigation and best practice approach;
- Ensure construction works and activities are completed in accordance with all planning conditions for the development;
- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;
- Ensure construction works and activities have minimal impact on the Natural Environment;
- Adopt a sustainable approach to construction; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials if possible, e.g. excavated stone, clay material;
- Ensure sustainable sources for materials supply where possible;
- Avoidance of any pollution incident or near miss as a result of working around or close to any watercourses and having emergency measures in place;
- Avoidance of vandalism;
- Keep impact of construction to a minimum on the local environment, watercourses and wildlife;
- Correct fuel storage and refuelling procedures to be followed;
- Good waste management and house-keeping to be implemented;
- Air and noise pollution prevention to be implemented;
- Monitoring of the works and any adverse effects that it may have on the environment.
- Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Comply with all relevant water quality legislation;

Ensure a properly designed, constructed and maintained drainage system appropriate to the requirements of the site is kept in place at all times.

2. SITE AND PROJECT DETAILS

2.1. Site Location

The proposed 110kV substation is located within the boundaries of the permitted Ballinrea solar farm (Planning Ref: 17-6784, ABP Ref. PL04.303013, as modified by 23/4564, ABP Ref. 318915) which is located off the Ballinrea Road, Carrigaline, Co. Cork. ITM coordinates for the centre of the site are X 571441, Y 565250. The subject lands for the proposed 110kV substation are located approximately 1.6km Northwest of Carrigaline, Co. Cork.

The proposed Grid Connection Route (GCR) will connect the permitted Ballinrea solar farm to the existing Raffeen substation (ITM Coordinates: X 574542, Y 563913). The route will exit the permitted solar farm and travel south to Ballinrea Cross before turning east and joining the N22. Further east, the route will exit the N22 to the south and follow several local roads to reach the Raffeen substation.

The locations for the proposed substation and grid connection are shown in Figure 1.

This site where the substation will be located is currently comprised of agricultural fields which are used for both tillage and grazing. One-off residential housing is located to the west and southwest of this site. Agricultural pastures border the site to the north, south and east. The boundary of the site consists of hedgerows and stone walls along all its boundaries. The site is not located within a flood zone. The site is located in an elevated area, with the site rising to 110 metres (m) OD at its highest point. The subject site is approximately 47.3 hectares in area, with access from the L2464 road to the western boundary.

The majority of the proposed grid connection route from Ballinrea Solar Farm to Raffeen substation will be installed within the corridor of the public road and will pass through the townlands of Ballinrea South, Ballinrea, Ardnacloghy, Shannonpark, Hilltown, Carrigaline Middle, Ballyhemkien, Carrigaline East and Raffeen, Co. Cork.

2.2. Development Description

The permitted development comprises of a 110 kV substation at the permitted Ballinrea Solar Farm (Pl. Ref. 17/ 6784, ABP Ref. 303013, as modified by 23/4564, ABP Ref. 318915), a tail fed 110kV underground grid connection from the proposed 110kV substation to the existing Raffeen 220 KV substation, a proposed new 110kV cable bay at the existing Raffeen 220kV Substation and associated works. The permitted development is intended to connect the permitted Solar Farm at Ballinrea (Pl. Ref. 17/6784, ABP Ref. 303013 as modified

by 23/4564, ABP Ref. 318915) and the associated permitted solar farm at Ballinvuskig (Pl. Ref. 19/5371, ABP Ref. 305186, as modified by 23/41837, ABP Ref. 318925) to the national grid.

The proposed 110 kV substation has been designed in accordance with EirGrid's functional specifications for 110 kV substations and comprises of a single bay extendable tail-fed type C substation, 1 no EirGrid Control Building,1 no. IPP Customer Control Building, and the electrical components necessary to transmit the electrical energy generated to the national grid. Works at the proposed substations also include lightning protection, perimeter security fencing, security lighting, drainage infrastructure, and a temporary construction compound.

The permitted development at Ballinrea will also include the temporary widening of the site entrance for the construction phase and subsequent reinstatement of the site entrance on completion of construction. The proposed works at Ballinrea also include the rearrangement of the permitted internal access track, the provision of 110kV underground cabling from the proposed substation to the public road, associated maintenance tracks and ancillary site development works at Ballinrea, Co. Cork.

The proposed grid route works are located in the townlands of Ballinrea South, Ballinrea, Ardnacloghy, Shannonpark, Hilltown, Carrigaline Middle, Ballyhemkien, Carrigaline East and Raffeen Co. Cork and will be carried out within the public roads.

The proposed grid connection comprises of 110 kV tail fed underground electricity cables of circa 6.6 km in length to be provided in excavated trenches and include associated fibre cable, underground ducting, 9 no. joint bays, communication chambers and all associated site development and reinstatement works.

The proposed cable route leaves the Ballinrea Solar farm joining the L2464 and travels south (c.1.8km), joining the L2473 to travel east (0.9km) toward Shannon Park. The cable route crosses through lands which have been CPO'd by Cork County Council to form part of the M28 road scheme and subsequently follows private lands for c. 0.15km before rejoining the N28 at a crossroads c. 0.19km before the Shannon Park Roundabout. The cable route continues east along the N28 corridor, through the roundabout and continues east for c. 0.49km before travelling south along the L2490 for c. 0.28km. To avoid a railway crossing, the route leaves the public road to cross private lands (c. 0.18km) and re-joins the L2490 continuing south (c. 1.05km) toward Carrigaline East. The route then turns northeast onto the (Raffeen Local Road) (c. 0.72km) turning east onto the entrance to the Raffeen 220kV substation (c. 0.30km). The cable leaves the private road at the east of the substation's southern perimeter crossing private land (c. 0.19km) and crosses the northeast perimeter of the substation compound before connecting into to the proposed 110kV cable bay at the northeast of the substation.

Development at the existing Raffeen 220kV will comprise of a proposed new 110kV cable bay, the provision of a new access track and ancillary site development works.

The layouts for the proposed substation and Grid Connection Route (GCR) is provided in Figure 2 below.

Figure 1- Site Location Map

Cork City

Cork County

A

B

C

Project Design Drawing Notes INTERNAL

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5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.

6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.

7. Final levels may vary depending on local ground conditions.

8. Path of cable route and location of associated joint bays may vary depending on site conditions. Deviations will remain within the planning boundary at all times.

Other services may be encountered along the route. Where such services are encounter and require relocation, this will be carried out in an appropriate manner within proximity to its location.

N

Drawing Legend

- Planning Application Boundary
- Landowner Boundary
- Ballinrea Solar Park Development (Pl.Ref.No: 23/4563)
- Ballinvuskig Solar Park Development (Pl.Ref.No:23/41873) Site
- X Notice
- Wayleave
- County Boundary
- Permited M28 Route (ABP: MA04.MA0014)

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DRAFT

DRAWING TITLE

Site Location Key Plan

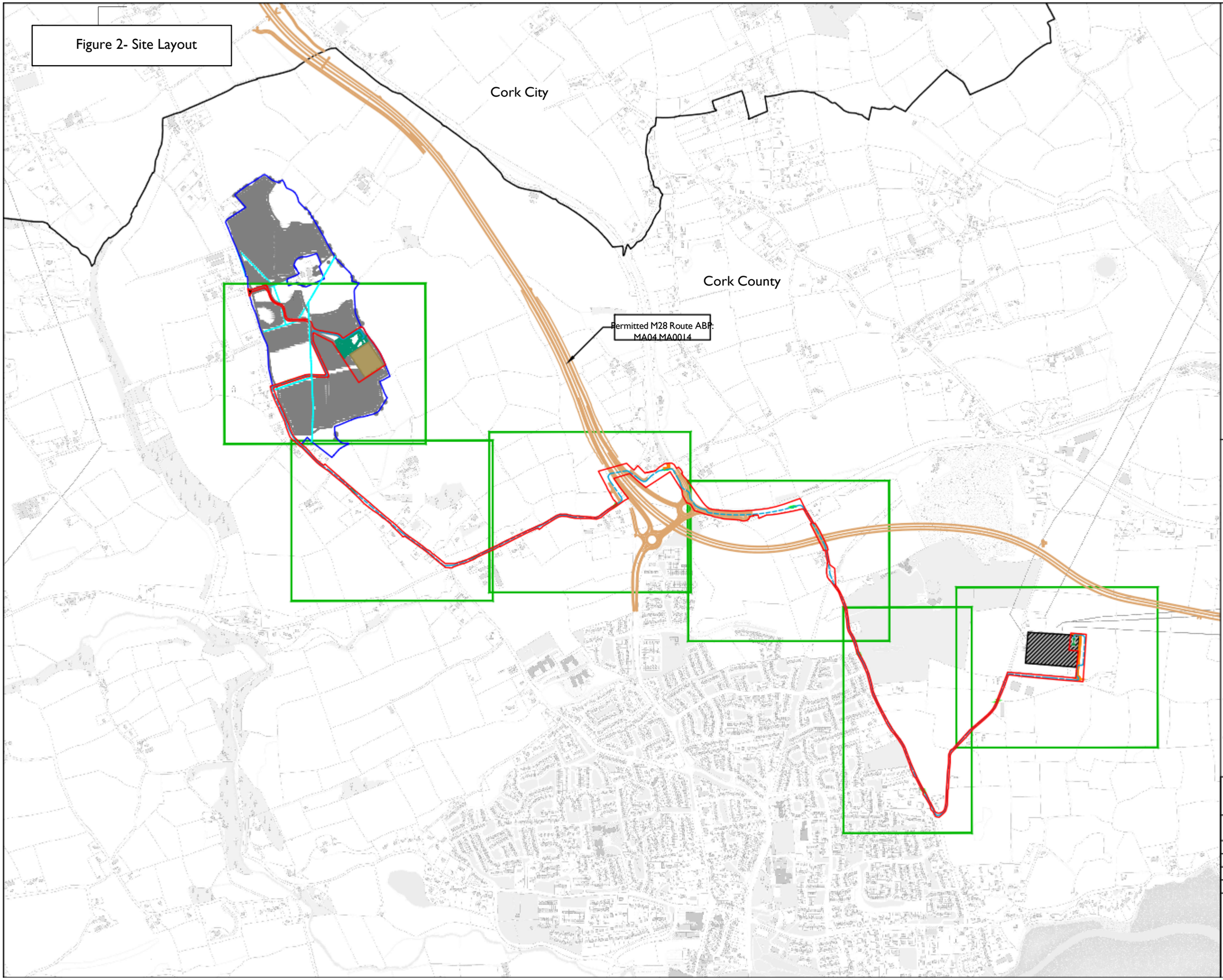
PROJECT TITLE

Ballinrea 110kV Substation and Grid Connection Strategic Infrastructure Development

DRAWING BY:	CHECKED BY:
KD	JW
PROJECT No.: 211231-c	DRAWING No.: 211231-c-02
SCALE: 1:20,000@ A3	DATE: 20.07.2023
OS SHEET No.: 6470, 6471, 6509, 6510	

MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
email: info@www.mkoireland.ie
Website: www.mkoireland.ie

Figure 2- Site Layout



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7. *Final levels may vary depending on local ground conditions.*
8. *Path of cable route and location of associated joint bays may vary depending on site conditions. Deviations will remain within the planning boundary at all times.*

Other services may be encountered along the route. Where such services are encounter and require relocation, this will be carried out in an appropriate manner within proximity to its location.

Drawing Legend

- Planning Application Boundary
- Landowner Bounda
- Underground Grid Connection
- Existing Raffeen 220kV Substation Refer To Drg 05887-DR-303 For Layout
- Temporary Construction Compound
- Ballinrea Solar Park Proposed Infrastructure (Pl.Ref.No: 23/4563)
- County Boundary
- Permitted M28 Route

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DRAWING TITLE:

Site Layout Key Plan

PROJECT TITLE:

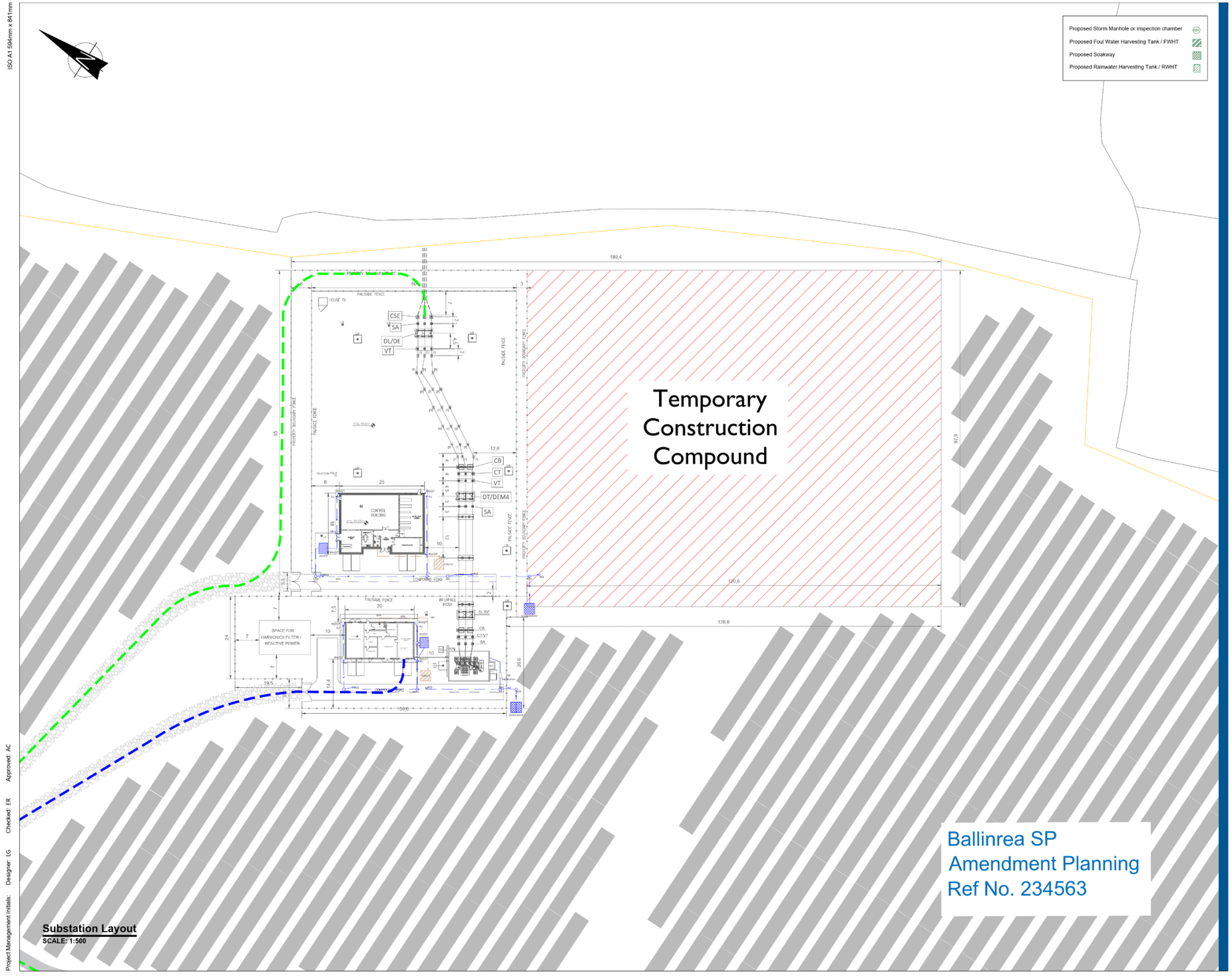
Ballinrea 110kV Substation and Grid Connection Strategic Infrastructure Development

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KD	JW
PROJECT No: 211231-c	DRAWING No: 211231-c-04
SCALE: 1:15,000@ A3	DATE: 20.07.2023
OS SHEET No: 6470, 6471, 6509, 6510	

MKO

Figure 3- Site Layout

ISO A1 594mm x 841mm



Project Management Initials: Designer: LG Checked: ER Approved: AC

tli GROUP

Head Office
Beenreigh,
Abbeydorney,
Tralee, Co. Kerry
Ireland
Tel: 00353 66 7135710

Regional Office
Basepoint Business Centre
Stroudley Road, Basingstoke,
Hampshire,
RG24 8UP, UK
Tel: 00 44 1256406664

PROJECT

Ballinrea Solar Park
110kV Grid Connection

CLIENT

Ballinrea Solar Farm Ltd

CONSULTANTS

MKO

NOTES: -

1. Design to be confirmed with Eirgrid as part of detailed design
2. Dimensions shown are as per current EirGrid Specifications at the time of submission. Dimensions may vary at time of construction to reflect any revisions to EirGrid Specifications.
3. Final Specifications of Buildings and Electrical Equipment is to be as per Eirgrid and ESB Specifications.
4. The Elevation of the Compound will be depicted by localized Topography such that Cut/Fill Earthworks associated with the construction of the Compound are balanced.
5. Dimesions shown in meters unless noted otherwise.

LEGEND: -

	Description
SA	Surge Arrester.
DL/DE	Line / Earth Disconnect.
DT	Transformer Disconnect
CT/VT	Current/Voltage Transformer.
PI	Post Insulator.
LM	Lighting Mast.
LS	Lamp Standard
CSE	Cable Sealing End
TP	Telecoms Pole

Proposed Access Track
Permitted Fencing
Proposed 110kV Cable Route
Proposed 33kV Cable Route
Proposed Drainage

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P03	26.06.23	For SID Planning
P02	01.06.23	For SID Planning
P01	03.05.23	For SID Planning
P00	18.04.23	For SID Planning

PROJECT NUMBER

05-887

SHEET TITLE

110kV Substation Layout

SHEET NUMBER

05887-DR-307

2.3. Conditions of Planning Permission

The Conditions of the Grant of Planning (Board Order No. ABP-317706-23) relating to environmental protection and relevant to the scope of this CEMP are summarised in Table 1. All works undertaken throughout the Construction Phase of the Permitted Development will be required to comply with the relevant environmental conditions and control measures of the Grant of Planning (Board Order No. ABP-317706-23), for the duration of the Construction Phase.

Table 1: Summary of Relevant Environmental Protection Conditions of Planning

No.	Condition of Grant of Planning (Board Order No. ABP-317706-23)	Reference
1	The proposed development shall be carried out and completed in accordance with the plans and particulars lodged with the application, as amended by the further details received on the 10th day of November 2023.	This has been addressed in Section 2.2
3	All of the environmental, construction, ecological and heritage-related mitigation measures, as set out in the Planning and Environmental Report and other particulars, including the Ecological Impact Assessment, the Natura Impact Statement, and the Construction and Environmental Management Plan, and other particulars submitted with the application, shall be implemented by the undertaker in conjunction with the timelines set out therein	This has been addressed in Section 3.2, 3.3., 3.4, 3.5 and 3.6.
4 (a)	A detailed plan for the construction phase incorporating, inter alia, construction programme, supervisory measures, noise, dust, and surface water management measures including appointment of a pollution prevention clerk of works, and the management, transport and disposal of construction waste.	This has been addressed in Sections 2.5 and 3.2., 3.3, 3.4, 3.5, 3.6, 3.9, 4
4 (b)	A comprehensive programme for the implementation of all monitoring commitments made in the application and supporting documentation during the construction period.	This has been addressed in Section 3.10
4 (c)	An emergency response plan.	This has been addressed in Section 5
4 (d)	A traffic management plan to include the timing and routing of construction traffic to and from the construction site and associated directional signage, to include proposals to facilitate the delivery of abnormal loads to the site.	This has been addressed in Section 2.6
4 (e)	Measures to prevent the spillage or deposit of clay, rubble or other debris on the public road network.	This has been addressed in Section 3.9
4 (f)	Alternative arrangements to be put in place for pedestrians, cyclists and vehicles in the case of the closure of any public road or footpath during the course of works.	This has been addressed in Section 2.6

4 (g)	No tree felling or vegetation removal shall take place between the period 1st March to 31st August.	This has been addressed in Section 3.10
4 (h)	A record of daily checks that the works are being undertaken in accordance with the Construction Environmental Management Plan shall be kept for inspection by the planning authority.	This has been addressed in Section 8
5	Prior to the commencement of development, a road safety audit stage 1 and 2 shall be submitted for written agreement of the planning authority and the undertaker shall undertake any recommendations within the road safety audit.	This has been addressed in Section 2.6
6	The undertaker shall comply with the transportation requirements of the planning authority and other relevant bodies for such works and services as appropriate.	This has been addressed in Section 2.6
7(a)	Lighting shall be provided in accordance with a scheme, details of which shall be submitted to, and agreed in writing with, the planning authority prior to commencement of development. All lighting within the site shall be cowled to prevent overspill outside the site and shall be designed to minimize impacts on bats in accordance with application documentation received.	This has been addressed in Section 2.5.2.5
7(b)	CCTV cameras shall be fixed and angled to face into the site and shall not be directed towards adjoining property or the road.	This has been addressed in Section 2.5.2.5
8(a)	All mitigation measures in relation to archaeology and cultural heritage as set out in the Ballinrea 110kV Substation and Grid Connection Planning Environmental Considerations Report (PECR) - Archaeology and Cultural Heritage (Rubricon Heritage Services Ltd dated June 2023) shall be implemented in full, except as may otherwise be required in order to comply with the conditions of this permission.	This has been addressed in Section 3.10.3
(b)	The undertaker shall engage a suitably qualified archaeologist (licensed under the National Monuments Acts) to carry out pre-development archaeological testing in areas of proposed ground disturbance within the greenfield portion of the scheme and to submit an archaeological impact assessment report for the written agreement of the planning authority, following consultation with the National Monuments Service, in advance of any site preparation works or groundworks, including site investigation works/topsoil stripping/ site clearance and/or construction works.	This has been addressed in Section 3.10.3
(c)	The report shall include an archaeological impact statement and mitigation strategy. Where archaeological material is shown to be present, avoidance, preservation in-situ, preservation by record [archaeological excavation] and/or monitoring may be required.	This has been addressed in Section 3.10.3
(d)	Any further archaeological mitigation requirements specified by the planning authority, following	This has been addressed in Section 3.10.3

	consultation with the National Monuments Service, shall be complied with by the undertaker.	
(e)	No site preparation and/or construction works shall be carried out on site until the archaeologist's report has been submitted to and approval to proceed is agreed in writing with the planning authority.	This has been addressed in Section 3.10.3
(f)	A suitably qualified archaeologist shall be retained to advise on, and establish appropriate Exclusion Zones around the external-most elements of Vulnerable Heritage Assets as identified in Ballinrea 110kV Substation and Grid Connection Planning Environmental Considerations Report (PECR)- Archaeology and Cultural Heritage (Rubricon Heritage Services Ltd. dated June 2023).	This has been addressed in Section 3.10.3
(g)	Exclusion zones shall be fenced off or appropriately demarcated for the duration of construction works in the vicinity of the monuments. The location and extent of each exclusion zone and the appropriate methodology for fencing off or demarcating at each location shall be agreed in advance with the National Monuments Service and the planning authority.	This has been addressed in Section 3.10.3
(h)	No groundworks of any kind (including but not limited to advance geotechnical site investigations and no machinery, storage of materials or any other activity related to construction will be permitted within Exclusion Zones.	This has been addressed in Section 3.10.3
(i)	The Construction Environmental Management Plan (CEMP) shall include the location of any and all archaeological or cultural heritage constraints relevant to the proposed development as set out in Ballinrea 110kV Substation and Grid Connection Planning Environmental Considerations Report (PECR) - Archaeology and Cultural Heritage (Rubicon Heritage Services Ltd dated June 2023) and by any subsequent archaeological investigations associated with the project. The CEMP shall clearly describe all identified likely archaeological impacts, both direct and indirect, and all mitigation measures to be employed to protect the archaeological or cultural heritage environment during all phases of site preparation and construction activity.	This has been addressed in Section 3.7
(j)	The planning authority and the National Monuments Service shall be furnished with a final archaeological report describing the results of any subsequent archaeological investigative works and/or monitoring following the completion of all archaeological work on site and the completion of any necessary post-excavation work. All resulting and associated archaeological costs shall be borne by the undertaker.	This has been addressed in Section 3.10.3

9	Drainage arrangements, including the attenuation and disposal of surface water, shall comply with the requirements of the planning authority for such works and services. Details to be agreed with the planning authority prior to commencement of development.	This has been addressed in Sections 3 and 3.2.2
10	An underground sealed wastewater holding tank shall be installed on site with effluent to be removed to a licensed wastewater treatment facility for treatment and disposal at regular intervals. Details of the holding tank shall be submitted for the agreement of the planning authority prior to the commencement of development.	This has been addressed in Section 3.9
11(a)	During the operational phase of the proposed development, the noise level arising from the development, as measured at the nearest existing or permitted (prior to the date of this Order) noise sensitive location shall not exceed:	This has been addressed in Section 3.6
	(i) An LeqT, value of 55 dB(A) during the period 0800 to 2200 hours from Monday to Saturday inclusive. [The T value shall be one hour] *(ii) An Leq,15 min value of 45 dB(A) at any other time. [The T value shall be 15 minutes]. The noise at such time shall not contain a tonal component. At no time shall the noise generated on site result in an increase in noise level of more than 10 dB(A) above background levels at the boundary of the site.*	This has been addressed in Section 3.6
(b)	All sound measurement shall be carried out in accordance with ISO Recommendation 1996:2007: Acoustics - Description and Measurement of Environmental Noise.	This has been addressed in Section 3.6
(a)	No additional artificial lighting shall be installed or operated on site unless authorized by a grant of planning permission.	This has been addressed in Section 2.5.2.5
(b)	CCTV cameras shall be fixed and angled to face into the site and shall not be directed towards adjoining property or roads.	This has been addressed in Section 2.5.2.5
(c)	Cables within the site shall be located underground.	This has been addressed in Section 2.5.2.5
(d)	All fencing, gates and exposed metalwork shall be dark green in colour. The roofs of the buildings within the substation compound shall be dark grey or black and the external walls shall be finished in neutral colours such as grey or off-white	This has been addressed in Section 2.5.2.5
13	All road surfaces, culverts, watercourses, verges, and public lands shall be protected during construction and, in the case of any damage occurring, shall be reinstated to the satisfaction of the planning authority at the undertaker's expense. Prior to the commencement of development, a road condition survey shall be carried out to provide a basis for reinstatement works. Details in this regard shall be submitted to, and agreed in writing with, the planning authority prior to commencement of development.	This has been addressed in Section 2.6.1

2.4. Archaeology, Landscape and Ecology

2.4.1. Existing Ecological Environment

The proposed substation and a section of the proposed Grid Connection Route (GCR) are located within the Ballinrea Solar farm site, located approximately 2.9 km from Cork Harbour Special Protection Area (SPA). A multi-disciplinary ecological walkover survey along the proposed grid connection route was undertaken on the 13th, 17th and 18th of July 2022, 13th of September 2022, and the 14th of October 2022 to inform the Ecological Impact Assessment (EcIA) and Natura Impact Statement prepared for the consented application.
The multi-disciplinary ecological walkover survey comprehensively covered the entire study area, providing baseline data on the ecology of the study area and assessed whether furthermore detailed habitat or species-specific ecological surveys were required.
Otter surveys were conducted over multiple dates during the multidisciplinary surveys, in order to determine the presence or absence of otter signs. Badger surveys were undertaken over multiple dates during the multidisciplinary surveys to determine the presence or absence of badger signs within proposed development site. An activity survey and bat roost inspection survey were completed in September 2022 along the grid connection route.

As the site comprises agricultural grassland, which provides potential foraging habitat for a number of SCI species associated with the SPA dedicated wintering bird surveys of the solar farm site were undertaken to determine whether the site was being used by these species.

The proposed substation and the initial c. 350m of the proposed GCR are located within the boundary of the permitted Ballinrea Solar Farm which comprised managed agricultural lands classified as Improved agricultural grassland (GA1) and Wet grassland (GS4). The site boundaries were delineated by a mix of Hedgerows (WL1) and Treelines (WL2). Tree lines were typically composed of ash, sycamore, elder, and hawthorn. An approx. 5 x 40-meter stand of Japanese Knotweed was recorded within the northern boundary of the proposed development site.

The majority of the proposed GCR remains within existing road infrastructure for approx. 6.39 km until it reaches the existing Raffeen substation. A short section of the GCR will go off road and will cross an area of recently excavated agricultural land cleared for the proposed M28 road development.
Historical mapping shows that the permitted Ballinrea solar farm site is drained via unmapped watercourses to the southeast of the site. These historical watercourses are shown to discharge into the Owenboy River downstream of the permitted solar farm site. The Owenboy river discharges to Cork Harbour SPA c. 4.1 km Downstream. The proposed grid connection route will cross this same unmapped watercourse

Figures 4 and 5 below shows the location of the habitats, the site outline and the layout of the gridline works.



Figure 4- Habitat Map West



Figure 5- Habitat Map East

2.4.1.1. Results of Ecological Surveys

No evidence of any species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477 of 2011) was recorded along or adjacent to the proposed grid connection route. No evidence of otter or badger were recorded during the surveys. No evidence of other mammal species, such as Irish hare, pygmy shrew and Irish stoat, which are protected species under the Irish Wildlife Act 1976-2022, was recorded during the site visit, but these species are likely to occur in the wider area, at least on occasion. No bat roosts were identified along the proposed grid route during the dedicated bat surveys undertaken.
No evidence of any other protected fauna was recorded within the site boundary during the site visits.

Agricultural grassland and hedgerow within the solar farm site provide potential suitable nesting and foraging habitat for a range of bird species, as do hedgerows and treelines along the proposed GCR. The majority of bird species recorded within the site are common in the wider area. The winter bird surveys undertaken for the solar farm also recorded golden plover, curlew, lapwing, and black headed gull foraging within the grassland habitat (these are some of the Species of Conservation Interest (SCI) for which Cork Harbour SPA is designated). The proposed substation site and GCR are located entirely outside the boundary of Cork harbour SPA. The proposed substation site and the GCR do not provide significant suitable habitat for these SCIs of the SPA, and these species were not recorded within or adjacent to the works areas during the multidisciplinary walkover surveys. No complete source- pathway- receptor chain for potential significant impacts on these SCIs, via disturbance or habitat loss resulting from the proposed development, was identified.

The proposed substation will result in the permanent loss of approximately 0.9 ha of improved agricultural grassland. The proposed GCR will result in the temporary loss of one small section and the permanent loss of one small section of hedgerow habitat (amounting to approximately 8m).



Figure 6 - Nationally designated sites in proximity to the Ballinrea 110kV Substation and Grid Connection route.

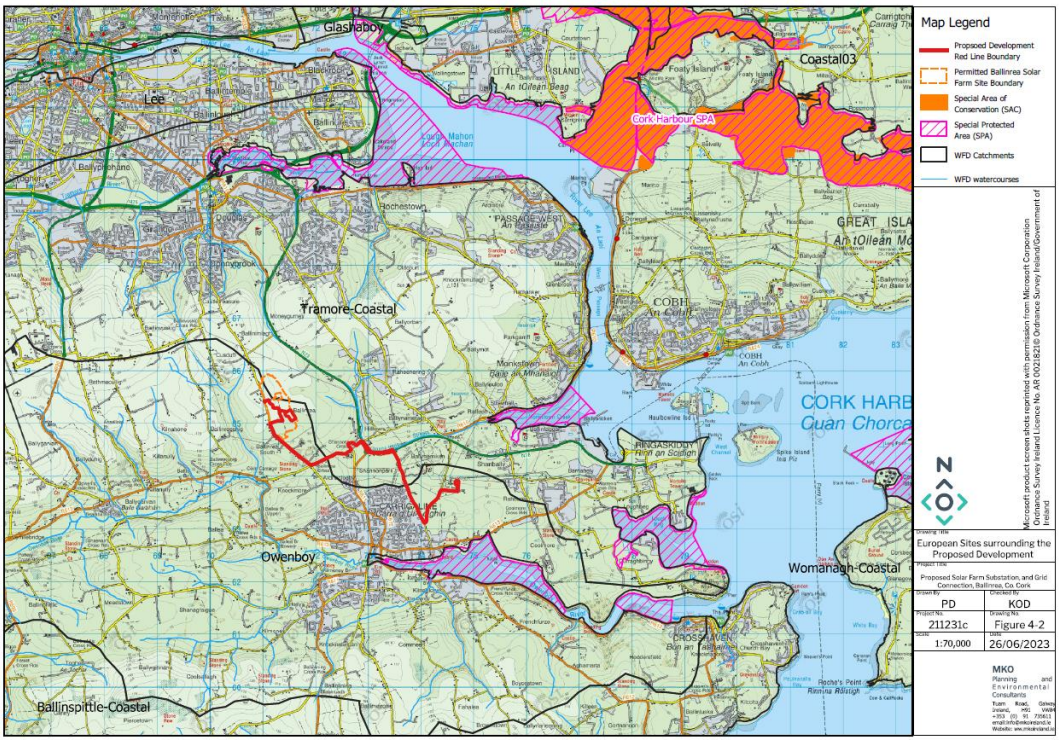


Figure 7 - Designated European sites in proximity to the Ballinrea 110kV Substation and Grid Connection route.

A landscape plan has been provided as part of the planning application for the permitted Ballinrea solar farm in which the proposed substation is located. This planting will constitute a permanent moderate positive impact on birds of local importance in the area. Overall, the proposed planting for the permitted solar farm will increase linear habitats available to bats, nesting habitats for birds and pollination areas for insects within the permitted Ballinrea solar farm and it is considered that the change of land use from intensive grazing practices to a renewable energy development will reduce pressures on the local environment as the application of fertilizers and pesticides will be reduced.

2.4.1.2. Impacts on Designated Sites

The proposed substation site and GCR are located entirely outside the boundary of Cork harbour SPA. The construction methodologies and best practice measures set out the environmental measures that will be adhered to during all phases of the proposed development. It incorporates mitigating principles to ensure that the work is carried out in a manner which blocks all potential pathways for impact on aquatic receptors.
The measures ensure that the construction and operation of the proposed development does not adversely affect the integrity of European sites.

2.4.2. Existing Archaeological Environment

The proposed development is situated south of Cork City, in the townland of Ballinrea (the location of the proposed substation), with the proposed underground grid connection crossing through the townlands of Ardnacloghy, Shannonpark, Hilltown, Carrigaline Middle, Ballymiken, Carrigaline and Rafeen.

The archaeological assessment submitted with the consented application (*Ballinrea 110kV Substation and Grid Connection Planning Environmental Considerations Report (PECR) - Archaeology and Cultural Heritage*) identified 112 sites of archaeological, and/or cultural heritage significance within the defined study areas. These sites include 28 RMPs (CH001–CH028), two NIAH registrations (CH029 and CH030) seven townland boundaries (CH091–CH097), four unregistered cultural heritage sites (CH098–CH101), and 59 previous archaeological excavations (CH031–CH090). A geophysical survey (for planning Ref. 17/06784) also identified 10 Areas of Archaeological Potential (CH102–CH112). The scheme is due to have a direct impact upon 10 CH sites, including three previous excavations, five townland boundaries, and two areas of archaeological potential.

A preceding geophysical survey (for planning Ref. 17/06784) and subsequent targeted programme of archaeological test trenching (License No. 23E0323) identified a number of small, isolated pits (6 No.) and postholes (5 No.) within the footprint of the proposed substation at Ballinrea.

The planning conditions attached to the grant of permission and the recommendations made in the reports submitted to the Council, and to the National Monuments Service, as set out in section 3.7 of this document, will be adhered to.

Figure 8 - Cultural Heritage Sites within the proposed development study area.



Key:

- Underground Grid Connection
- Planning Application Boundary
- Grid Connection Cable Study Area
- Proposed Substation
- Proposed Substation Study Area

CH Site_Baseline Value

- Very High
- High
- Medium/ Low
- Low
- Townland Boundary

N

0 160 320 480 640 800 m

Rubicon Heritage

Project: Ballinrea-Rafeen Connection Route	
Date: 13/09/2024	Prepared by: H.Sims
Scale: 1:16,000 @ A3	Approved by: E. O'Flaherty
Status: Final	Revision Number: 1.9

2.5. Construction Methodologies Overview

2.5.1. Introduction

An experienced main contractor will be appointed for the civil works for the construction phase. The main contractor for the works will be required to comply with this CEMP and any revisions made to this document. An overview of the proposed Construction Methodologies for the Proposed Development (110kV substation, grid connection and all associated works) is provided below.

2.5.2. Overview of Proposed Construction Methodology

The proposed construction methodology is summarized for each main construction component under the following headings:

- Site Enabling Works
- Temporary Construction Compound
- Electrical Substation and Control Buildings
- Site Underground Cabling
- Underground Cable Grid Connection
- Lightning Protection Poles
- Perimeter Fencing and Security Lighting
- Drainage Infrastructure

2.5.2.1. Site Enabling Works

Prior to construction works at the permitted development site, a number of enabling works will be carried out. These enabling works will be comprised of widening works on the site entrance along with installation of sections of access tracks. A new section of access track will be installed at the existing Raffeen substation.

These new access tracks and temporary widening works of the site entrance will have similar construction methodologies which are as follows:

- Establish alignment of the new site track in line with construction drawings and mark out the centre lines with ranging rods or timber posts.
- The access tracks will be of single-track design.
- Access tracks leading to the proposed substation compound have been designed with a width of 6m to ensure compliance with EirGrid's functional specifications for 110 kV substations.
- All material excavated during track construction will be either reused for backfilling and reinstatement adjacent to the track or exported off site to an authorised waste recovery facility.
- The subsoil will be excavated down to a suitable formation layer of either firm clay or bedrock.
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface.
- The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used.
- During earthwork activities, the following mitigation will be adhered to:
    - *Excavation depths will be kept to a minimum.*
    - *Material that is not re-used will be transported off site to a designated waste facility.*
    - *Suitable stone material will be imported to the site to be used as backfill.*
    - *Stockpiling of soil during construction, should it be required, will take place in designated areas within the site boundary away from any watercourses or waterbodies.*
    - *A silt fence will be erected around any stockpiling of material to prevent any sediment-laden run-off occurring.*

Once construction has been completed, it is proposed to reinstate the site entrance to its original state or as conditioned by the planning authority.

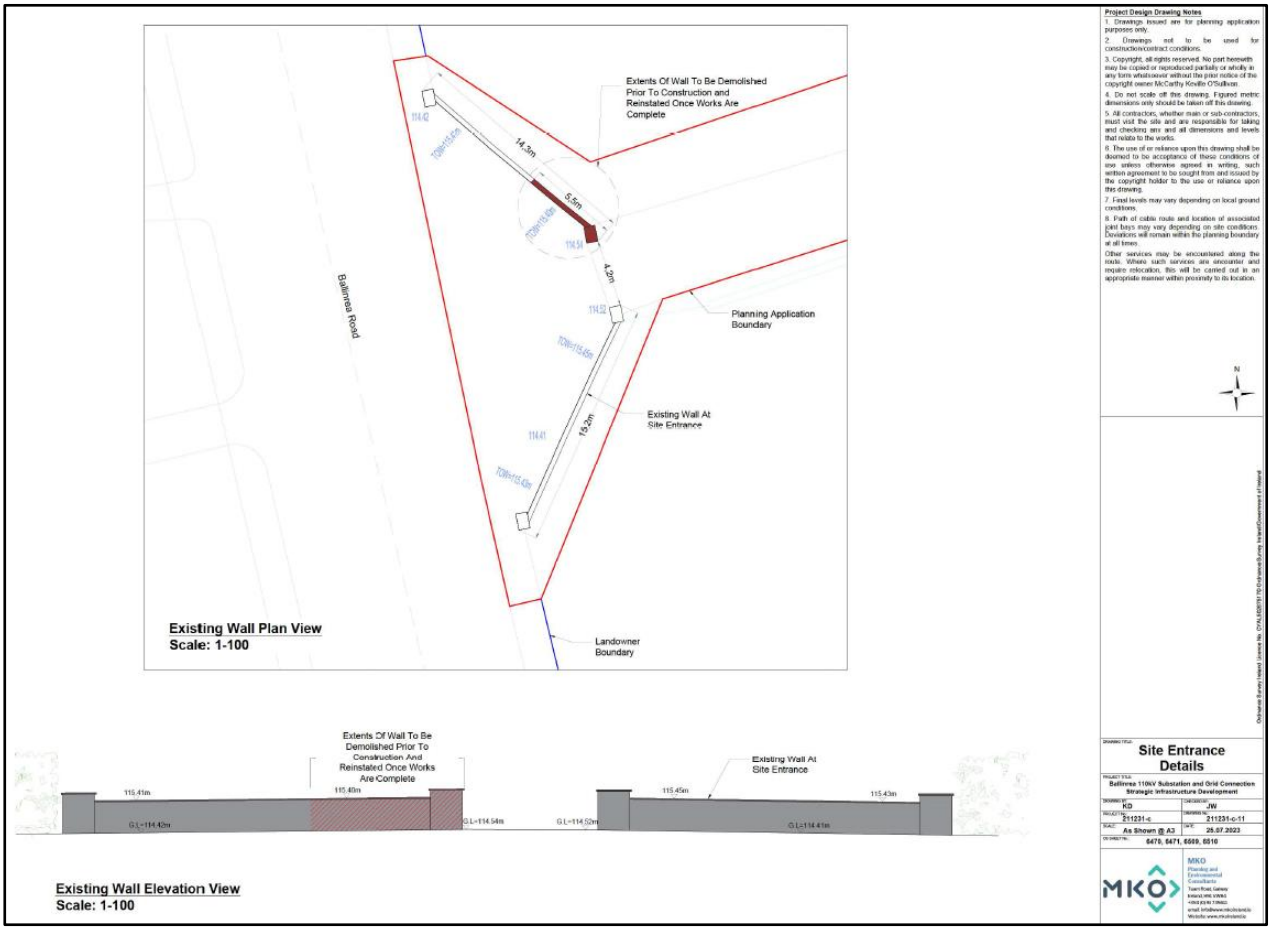


Figure 9-Site Entrance Works

The proposed access tracks and their respective locations are outlined in Figure 2 above.

2.5.2.2. Temporary Construction Compound

The permitted site will consist of a temporary construction compound which will be installed within the confines of the site boundary adjacent to the proposed location of the substation and a minimum of 50m from nearby watercourses if appropriate. The compound will consist of temporary site offices during the construction phase, staff facilities and car-parking for staff and visitors. A typical compound layout can be seen in Figure 10 below (refer to Fig 12 for Compound Location);

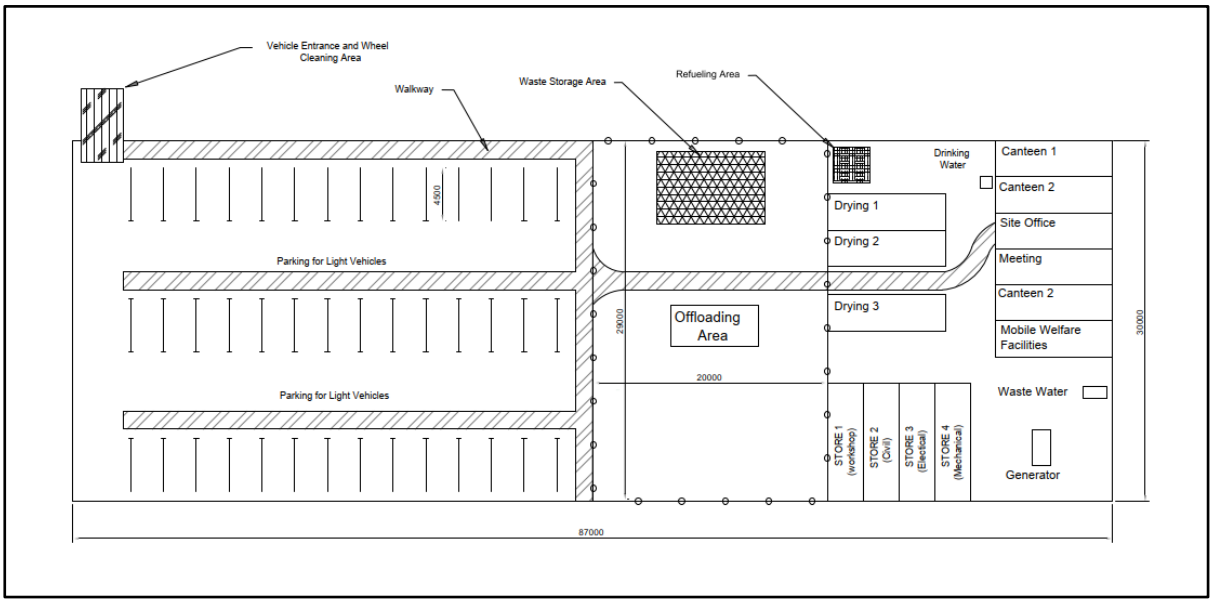


Figure 10 - Typical Construction Compound Layout

The compound will typically be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter.
- The compound will be established using a similar technique as the construction of the access tracks as discussed above.
- A layer of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers.
- If necessary, the compound will be fenced and secured with locked gates, although fencing would only be utilised where significant risk of danger to third parties or vandalism is envisaged.
- During the construction phase, welfare facilities in a site container with waste holding tanks will be used. This will be maintained and emptied by an appropriately licensed contractor on a regular basis and will be removed from the site on completion of the construction phase. Refer to drainage report included as 1)Appendix 6: Drainage Report.
- The construction compound will be decommissioned once all construction works were completed at the site.

2.5.2.3. Electrical Substation and Control Buildings

Ballinrea 110kV substation will be constructed to connect Ballinrea Solar Farm to the existing 220kV Raffeen substation. The substation will be comprised of a control building, switchgear building, transformer compound and busbar compound. The proposed 110kV substation and control buildings will be constructed by the following methodology:

- The area of the substation, control buildings and other ancillary components will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to nearby temporary storage area for later use in landscaping.
- Stockpiles of excavated material will be sealed with the back of an excavator bucket. Silt fencing will also be installed, if required.
- The dimensions of the substation area have been designed to meet the current requirements of the ESB/ Eirgrid;
- The required level, platform will be established and finished with well-graded imported granular fill, compacted in layers and finished with a suitable capping layer to the desired level;

- The transformer area will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- Control buildings will be built within the substation compound;
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix;
- The substation will be constructed with masonry blockwork. The block work walls will be built up from the footings to damp-proof course (DPC) level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work walls will be built up from the footings to damp proof course level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather;
- The substation plinths will be shuttered and poured with reinforced concrete. An anti-bleeding admixture will be included in the concrete mix;
- The electrical equipment will be installed on the concrete plinths and commissioned;
- All wastewater from the staff welfare facilities will flow to a sealed storage tank which will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Refer to Drainage report included as Appendix X.
- Water will be provided to the substation via a new connection to existing nearby Uisce Eireann infrastructure.

2.5.2.4. Lightning Protection Poles

For the purpose of lightning protection in the Proposed Development, lightning protection monopoles (c. 18m height) will be installed at equal intervals around the extents of the site of the proposed 110kV substation. The lightning protection monopoles shall be either be set in concrete or anchor bolted to a concrete base.

2.5.2.5. Perimeter Fencing, Security Lighting and CCTV

The site of the permitted substation will be secured with palisade fencing in accordance with the details set out during the design stage. This type of fencing is proposed to maximise security at the site both in terms of human and potential animal encroachment onto the application site once it is operational.

Security lighting will also be installed at the site of the proposed substation. It is anticipated that such lighting will be installed on metal poles which will be set into concrete. The lights will be motion activated which will eliminate the need for continuous lighting at the site.
Temporary lighting will be used during the construction stage with permanent lighting as a permanent solution through the operation of the site.
Temporary lighting will be required for safe access and egress of personnel within the construction compound during the agreed working hours and for emergencies and security outside of these hours. For construction the following will be implemented onsite:
• As per spec 18248 a minimum general lighting level of 20 lux shall be maintained on areas to be accessed on site. The following lighting levels shall apply;

- o Internal walkways and access areas – 50lux
- o Internal work areas – 100lux
- o External site access areas routes and roads – 20lux
- o External construction compound areas – 20lux
- o External lifting and crane operation areas – 100lux

• Directional light fittings will be used that will minimise light pollution in the area;
• Arc lighting will not be permitted;
• Fencing will be erected around the construction site prior to commencement of construction

A lighting scheme has been prepared and can be found in Appendix 2.

The subject site will not be manned on a permanent basis. It is proposed to augment the physical site security with Closed Circuit Television. The CCTV system will include detection control and recorded and will be connected to a remote alert center where security will be monitored. The cameras will be monitored on a continual basis using infrared lighting as the facility will be unlit at night-time. The CCTV cameras will be set up on poles (most likely the same poles as the lighting). They will be orientated in such a way so as to provide clear views of the substation compound area and all its associated components whilst also avoiding views on to external third-party properties.

2.5.2.6. Underground Cabling Grid Connection

The proposed underground electrical cabling consists of the 110kV underground electrical cabling connecting the proposed 110kV substation to the existing 220kV substation at Raffeen.

The proposed underground grid connection (UGC) will be approximately 6.6km in length and will consist of a trench containing 3 No. 160mm diameter HDPE power cable ducts, 2 No. 125mm diameter HDPE communications duct and 1 No. 63mm diameter Earth Continuity Conductor to be installed in an excavated trench, typically 825mm wide by 1315mm deep, with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings. It will be installed following the existing public road corridor with some areas passing through private land adjacent to the Raffeen substation.

The ducts will be installed, and the trench reinstated in accordance with the local roads authority within Cork County Council where installed in public roads and reinstated in accordance with the landowner's requirements where installed in private lands. The installation of the electrical cabling/fibre cable will be pulled through in approximately 550 - 750m sections . Construction methodologies to be implemented and materials to be used will ensure that the underground cable (UGC) is installed in accordance with the requirements of EirGrid, the Council and private landowners.

Surface cable markers will be placed along the route where cable depth is unavoidably shallow, due to constraints such as existing services, to indicate the precise location of the UGC. These markers will be metallic plates in accordance with ESB standards. Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. The precise location of marker posts will be will be determined during the course of a detailed design process.

It is anticipated that the grid connection will be installed in 10 stages which are described in table 2-1 below.

Table 2- 1 Summary of Grid Connection Route Installation Stages

Section	Description
1. UGC from Ballinrea Substation to public road	This section of the grid connection route begins within the Ballinrea substation compound. The cable exist at the east side of the substation and runs through the access track for approximately 727m before entering the local L2464 road. There are existing watermain services located along this road and these will be identified prior to the cable entering the road corridor. This section of underground cable will have a length of 645.7m.
2. UGC within Public Road – Joint Bay 2	This section of the underground cable runs in a southerly direction along the local L2464 road. Cable length in this section is approximately 677.4m.
3. UGC within Public Road – Joint Bay 3	The underground cable continues on the L-2464 until the crossroads where it takes a left towards Shannonpark on the L-2473. Cable length in this section is approximately 669.3m.
4. UGC within Public Road – Joint Bay 4	The underground cable continues along the public road corridor of the L2473 road. Cable length in this section is approximately 675.9m.
5. Private Land – Joint Bay 5	At this point the cable exits the public road and heads north through private land. The cable route will cross what is the proposed M28 development at this point. There are 2 stream crossings which will be crossed using a dam and flume crossing methodology. This crossing methodology is outlined in detail below. Cable length in this section is approximately 454.5m.
Section	**Description**
6. UGC N28 National Road	The cable continues across the National N28 road towards Ringaskiddy. The cable will transvers in the hard shoulder on the right-hand side of the road. Cable length in this section will be approximately 674.9m.
7. Joint Bay 7	The cable exits the N28 national road and turns right at Fern Hill Road (L2490). Cable length in this section will have an approximate length of 744.1m.
8. Joint Bay 8	The cable continues south along the Fern Hill Road (L2490). Cable length in this section is approximately 667.9m.
9. Joint Bay 9	The cable follows a U turn in the road towards Raffeen Substation on the L6472 road. The cable will travel along a water pipe for a part of this section. Cable length in this section will be approximately 736m.
10.	The cable continues for approx. 130 meters and then turns right into the Raffeen substation. The cable follows the existing access track before turning North where it will be required to cross an existing gas line twice before turning in to Raffeen Substation. Cable length in this section will be approximately 718.9m.

The underground cabling will be laid using the following methodology:

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures as required by conditions where relevant;

- All existing underground services shall be identified on site prior to the commencement of construction works;
- Traffic management measures will be implemented in accordance with those included in the Traffic Management Report, and a detailed Traffic Management Plan will be prepared and agreed with Cork County Councils;
- The excavated trench will be approximately 600mm in width and approximately 1220mm deep when installed using a standard design, both within the public road network and within private lands;
- The base of the excavated trench will be lined with sand bedding to be imported to site from a local licensed supplier.
- The 160mm diameter HDPE cable ducting will be placed into the prepared trench, inspected and backfilled.
- Excavations on road sections which is over 90% of the grid route will be disposed of at a licensed facility and build up of trenches to Purple book specification in accordance with all requirements of the Road opening licence.
- The ECoW will be appointed to oversee cable laying works at the stream crossings. This ecologist will oversee the protection of local fisheries habitats.
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;
- Where required, grass will be reinstated by either reseeding or by replacing with grass turves.
- No more than a 100m section of trench will be opened at any one time. The second 100 metres will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section. Details on the methodology of reinstatement on public roads can be found in the conditions of road opening license;
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- In the event that culverts require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works
- Works will only be conducted in normal working hours of Monday to Friday 08:00 to 20:00 and Saturday 08:00 to 18:00, with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency;

The contractor will ensure that there are no open excavations at the end of each working day with all trenches backfilled accordingly. Any works areas which have to be secured with will be done so using mobile security fencing which will be erected to secure the works and prevent the general public enter the works area during the works as well as outside normal working hours. It is not proposed to use hoarding as a means of securing the works area.



Plate 2-1 Typical Cable Trench View

Prior to beginning construction work the contractor will scan the proposed route with a cable avoidance tool (CAT), carry out visual inspection of the area and may carry out further below ground surveys if deemed necessary. If any previously unidentified services are discovered the site engineer will inform the design of the issues and possibly recommend a solution that works with the new constraints.

In some instances, it may be necessary to relocate existing underground services such as water mains or existing cables. In advance of any construction activity, the contractor will undertake additional surveys of the proposed route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

If existing low voltage underground cables are found to be present, a trench will be excavated, and new ducting and cabling will be installed along the new alignment and connected to the network on either end. The trench will be backfilled with suitable material to the required specification. Warning strip and marking tape will be laid at various depths over the cables as required. Marker posts and plates will be installed at surface level to identify the new alignment of the underground cable, the underground cables will then be re-energised.

In the event that water mains are encountered the water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the utility standards.

2.5.2.6.1. Existing Underground Services

Any underground services encountered along the route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300 mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations, an additional layer of marker tape will be installed between the communications layer and yellow top-level marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35 N/mm2 concrete surrounding the ESB ducts where adjacent

services are within 600 mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

2.5.2.6.2. Trenching and Ducting in Public Roads

As per the TLI Construction Methodology Report which accompanies this CEMP as a separate document, the trenching and ducting works will be completed using the following methodology:

- Grade, smooth and trim trench floor when the required 1315mm depth and 825mm width have been obtained.
- Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
- Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap/bung to the end of each duct run to prevent the ingress of dirt or water.
- Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
- Place cable protection strips on compacted CBGM B directly over the ducts.
- Lay the top row of ducts onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
- Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
- Place red cable protection strip on top of compacted CBGM B over each set of ducts.
- Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified and place warning tape.
- For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the specification and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities.
- For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100 mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner, for this project the cable will be mostly within public roads with some sections through solar farm access tracks and private land.
- Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

2.5.2.6.3. Joint Bays

Joints Bays are to be provided approximately every 550 to 750m along the UGC route to facilitate the jointing. Joint Bays are typically 2.5m x 6m x 1.75m pre-cast concrete structures installed below the finished ground level. These joint bays will be installed in line with specifications outlined in the Eirgrid 110 kV Underground Cable Functional Specification Document.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between Solar Farm and the existing Raffeen 220kV Substation. Earth sheath links are used for earthing and bonding cable sheaths of underground power cables, installed in a flat formation so that the circulating currents and induced voltages are eliminated or reduced. Earth sheath link chambers and communication chambers are located close to joint bays. Earth sheath link chambers and communication chambers will typically be pre-cast concrete structures with an access cover at the finished surface level.

The precise siting of all joint bays, earth sheath link chambers, and communication chambers is subject to

approval by ESBN and Eirgrid. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions. The marker posts will consist of a corrosion-proof aluminium triangular danger sign, with a 750mm base, and with a centred lightning symbol, on engineering grade fluorescent yellow background. They will be installed in adequately sized concrete foundations and will also be placed where the cable has not been buried to the standard depth, due to existing road conditions.

Where off-road joint bay locations are utilised, access tracks from the road to the joint bay locations will be constructed by stripping surface soils, placing geotextile reinforcement at subgrade level followed by a layer of granular material in accordance with the specification to form a working surface for vehicle. This surface will be regularly assessed for damage and additional aggregate added if required. Any roadside drains within the temporary works area will be culverted and check dams made from stone or sandbags covered with terram will be inserted upstream and downstream of these culverts to intercept any solids generated during the insertion or wash out during the works. Any surplus materials will be stockpiled separately for reuse or appropriate disposal, subject to validation and waste classification sampling.

Joint bay locations will be excavated using conventional mechanical excavators. Joint bay excavations will be advanced to the required depth and width with the excavation floor graded and smoothed. A blinding layer will be placed at the base of the excavation to facilitate the construction of a concrete base and side walls (in-situ or precast).

Ground water and surface water accumulating in the base of excavations will not be pumped directly to roadside drains or watercourses unless it is clean and free from solids. Contaminated water will be either treated onsite prior to discharge or tankered offsite to a suitably licensed disposal facility.

Where joint bays are located under the road surface the joint bay will be backfilled with compacted in accordance with the specification. Road surfaces may be temporarily reinstated as specified by the local authority. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay and are then removed at the cable installation stage of the project.

2.5.2.6.4. Cable Installation

The installation of cabling normally involves pulling three individual conductors into three separate ducts. The cable pulling winch must be set at a predetermined cut off pulling tension as specified by the designer. The cable will be connected to the winch rope using approved suitably sized and rated cable pulling stocking and swivel or the pulling head fitted by the cable manufacturer. Once the “two sections” of cable are pulled into the joint bay, a jointing container will be positioned over the joint bay and the cable jointing procedure carried out in this controlled environment.

Following the completion of jointing and duct sealing works in the joint bay, place and thoroughly compact cement-bound sand in approximately 200 mm layers to 100mm above the top of the cable joint base to provide vertical support. A cable protection strip will be installed at this depth and the joint bay backfilled with cement- bound sand and reinstated to match surrounding areas. It is noted that once the cable installation is complete, the cables will be permanently covered and will not be perceptible.

2.5.2.6.5. Underground Cable Watercourse/Culvert Crossings

The proposed grid connection route will traverse a total of 2 no. watercourses. It should be noted that other culverts may be encountered during the construction stage. The installation of trenching and ducting will involve instream works at these locations. All instream works will be required to be done during the permitted fishery season and in full consultation with IFI. Open trench dam and flume involves damming the watercourse upstream and downstream of the proposed trench and placing an appropriately sized (usually 500mm to 1000mm diameter) flume pipe between the two dams to allow the water to flow through the pipe creating a dry cell in between the two dams. A trench is then opened, the services brought across, the riverbed is re-instated, and the dams and temporary flume pipe taken away. This method ecologically beneficial and is less likely to stir up suspended solids than pumping and there are no mechanical parts to break down.

To facilitate the works, these watercourses will be dammed, and the water diverted over or around the works area using either flume pipe or a diversion channel. Following completion of the works at the watercourse, the dam will be removed, and the watercourse reinstated.

Should an alternative methodology option be required for individual crossings during the construction process this will be agreed with the relevant authorities including Cork County Council prior to works commencing.

2.5.2.7. Future M28 Motorway Crossing

Motorway crossing detail is required in preparation for the future development of the M28 Cork to Ringaskiddy motorway.

There will be 2 crossings of the future development of the M28. Agreement has been reached to use the service corridor for the M28 for the first crossing. The second crossing will be within the existing road corridor which will be passing underneath the motorway. It is proposed to cross the future Motorway M28 at a depth of 3 meters from ground level to the top of duct. It will be a concrete encased undercrossing with steel plates and rebar mesh. The ducts will be backfilled with concrete grade C25/30. ESB red cable markers will be place 225mm above the ducts. All crossings will be approved by the M28 team prior to construction.

2.6. Traffic Management Proposals

The site for the construction of the proposed substation will be accessed via the existing domestic/agricultural site entrance off the local L2462 road. Required sight lines in excess of 90 m with a setback distance of 2 m are available. It is proposed to widen the entrance slightly during the construction stage to facilitate HGVs. When vehicles are entering the site, or leaving the site, these movements will be supervised by designated members of staff who will act as road marshals. The construction site gates will be kept closed when not in use and monitored by security.

Deliveries of materials for the construction of the Grid Connection underground electrical cabling route will be completed on an as needed basis via the public road network along the identified route, this can be seen on Figure 11 below. Due to the nature of the Grid Connection underground electrical cabling route, the proposed works will be transient in nature along the public road network in which the underground electrical cabling route is proposed. As such, deliveries of construction materials will utilise the surrounding road network along the underground electrical cabling route as it moves along the public road network in which it's proposed. The Traffic and Transport Assessment which was prepared for the permitted development and evaluates the likely effects of traffic on during construction and operation of the site can be found in 1)Appendix 3: .

The proposed underground electrical cabling route is circa. 6.6 km in length and is located predominately within the public road corridor.

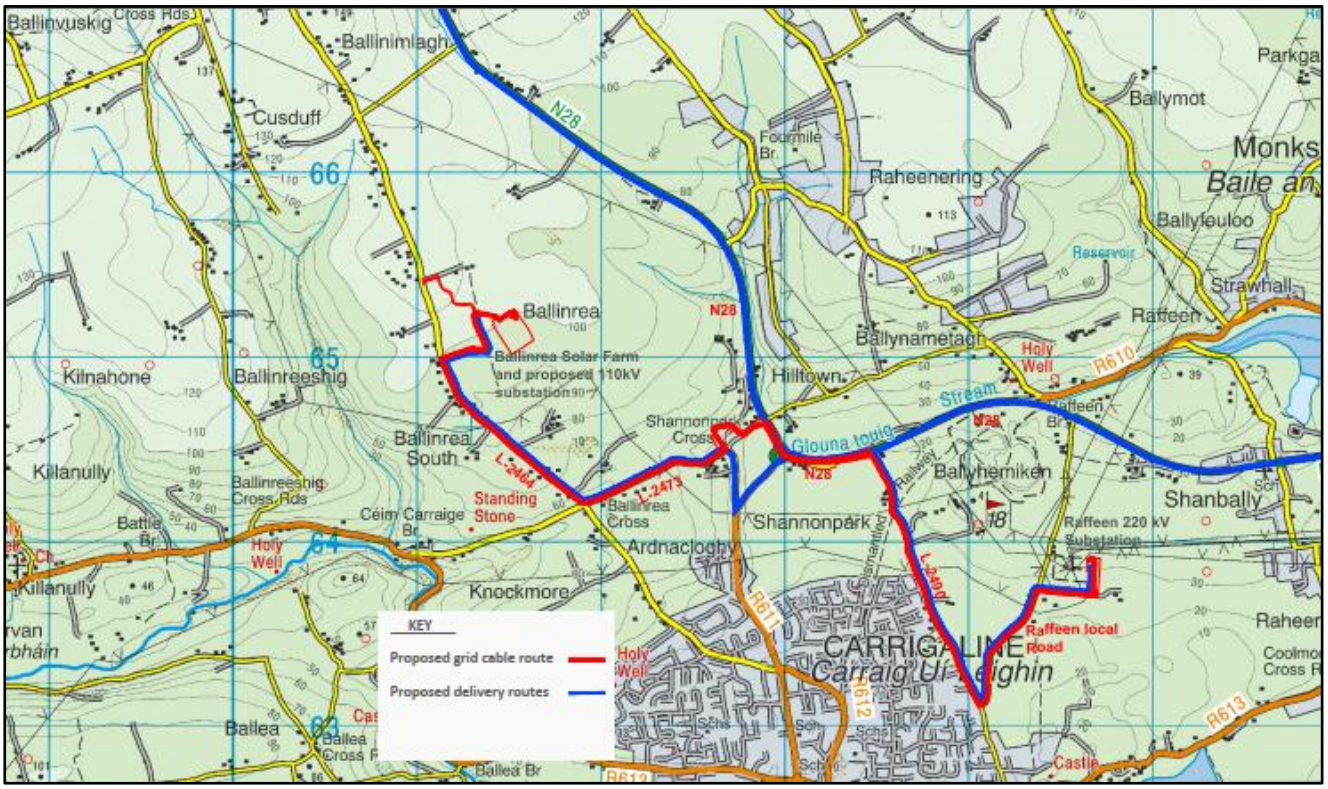


Figure 11- Proposed Delivery Route

2.6.1. Traffic Mitigation Measures during the Construction Phase

A detailed TMP incorporating all mitigation measures will be prepared prior to commencement to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval. The TMP will include the following:

Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.

Delivery Programme – a programme of deliveries will be submitted to Cork County Council in advance of deliveries of material to the cable route and substation sites. Liaison with the relevant local authorities and TII will be carried out where required regarding requirements such as delivery timetabling.

Information to locals – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane / road closures, via letter drops and posters in public places. Information will include the contact details of the Contract Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided.
Local access to all properties located on the cable grid route will be maintained at all times.

A Pre and Post Construction Condition Survey – A pre-condition survey of roads associated with the proposed development will be carried out immediately prior to construction commencement to record an accurate condition of the road network at the time in compliance with Condition 13 of the planning permission. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re- instated to predevelopment condition, as agreed with the local authority engineers.

Liaison with the relevant local authority – Liaison with Cork County Councils roads department will continue through the duration of the construction period. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, (and in compliance with Ballinrea 110kV Substation and Grid Connection – Traffic and Transport Assessment andthe provisions of the CEMP), the Roads section will be informed of the name and contact number of the Project Supervisor of the construction stage as well as the Site EHS Manager.

Identification of delivery routes – These routes will be agreed and adhered to by all contractors at all times.

Travel plan for construction workers – While the assessment above has assumed the worst case that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking, which will be at the construction compound.

Temporary traffic signs – As part of the traffic management measures temporary traffic signs will be put in place at the location where works are being undertaken along the cable grid route, at locations where temporary local diversions are in place. All measures will be in accordance with the "Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works" Department of Transport (DoT) now Department of Transport, Tourism and Sport (DoTT&S) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at each construction site location along the route

Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network which may include wheel washing facilities at the entrance to the site and or sweeping / cleaning of local roads as required.

Re-instatement works - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the Cork County Council Engineers. A roads conditions survey (and any other analyses required by the Roads Section) will be undertaken immediately prior to construction commencement of the project to assess the condition of the road network at that time and to agree any required works with the local authority. Such a survey will be repeated immediately after completion of the construction phase of the project in order to ensure that any reinstatement works were carried out to a satisfactory standard as required by Cork County Council.

Road Opening License – Roads works associated with the grid connection cabling will be undertaken in line with the requirements of a road opening licence as agreed with Cork County Council.

Diversions and road closures – Reasonable access to residences, farms and businesses will be maintained at all times during any road closures associated with the grid connection works. The details of this will be agreed with the roads authority in advance of works taking place. The network of local roads in the area will be used for traffic diversions for local traffic in order to expedite the works and limit the duration of the impact of the grid connection works.

Trench Reinstatement - Trenches on public roads, once backfilled, will be reinstated to the satisfaction of the roads authority. The roads conditions survey, which will be undertaken immediately prior to construction commencement of the project, will ensure that any section of road along the grid connection route is not left in a degraded condition. The repetition of the survey immediately after completion of the construction phase of the project will ensure that any reinstatement works were carried out to a satisfactory standard.

3. ENVIRONMENTAL MANAGEMENT

3.1. Introduction

This CEMP has been prepared and presented as a standalone document and includes all drainage measures required to construct the Proposed Development. The drainage proposals will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles set out here and will also be in full compliance with the planning consent and mitigation measures as presented in other relevant planning documents. The following sections give an overview of the drainage design, dust and noise control measures and a waste management plan for the site.

3.2. Protecting Water Quality

3.2.1. Environmental Management in the Construction Phase

Timing of civil works can significantly influence the potential impact upon the water environment, both surface and ground. Operations during wetter periods of the year pose a greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snow events. Traditionally, construction activity undertaken during the drier summer months would result in less erosion and siltation. Construction activities should be avoided during or immediately after a prolonged or intense rainfall event and work will cease entirely near watercourses when it is evident that water quality is being impacted.

3.2.2. Site Drainage Principles

The protection of the watercourses within and surrounding the site, along the grid connection route, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. No routes of any natural drainage features will be altered as part of the Proposed Development as new watercourse crossings are kept to a minimum to facilitate the Proposed Development. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. Buffer zones around the existing natural drainage features have informed the layout of the Proposed Development. The drainage regime on the site will be subject to regular inspection and cleaning/clearing as necessary.

A Drainage and Wastewater Design Report has been prepared by DOSA Consulting Engineers and is attached as 1)Appendix 6: .

3.2.3. Existing Drainage Features

There are a number of existing water features located in close proximity to the proposed development site. The primary watercourse within the solar farm site is the South Ballinrea Stream (EPA Code: 19S33 – Order 1) and its unnamed tributary. Both of these watercourses are located in the eastern section of the site. The South Ballinrea Stream leaves the solar farm site at the south-east corner and flows in a south-easterly direction for approximately 2.7km where it then flows into the Owenboy River (EPA Code: 19O01 – Order 4). There is another small watercourse located adjacent to the site's southern boundary. This is named on the EPA Map as being the Rathmacullig East (EPA Code: 19R28 – Order 1). This small stream flows south for approximately 2.6km where it then flows into the Owenboy River, 690m upstream of the confluence of the Owenboy-South Ballinrea.

The three watercourses outlined above are listed as 'At risk' in the WFD objectives risk assessment completed by EPA Catchments Unit in 2020. The status of these watercourses has been assigned a 'Moderate' status in the River Waterbody Water Framework Directive (WFD) Status (2016-2021).

There are also a number of drainage ditches located within the confines of the permitted site. These will be retained in-situ (apart from minor alterations to facilitate access tracks, the details of which were outlined in the permitted solar farm development (Planning Ref: 17/6784).

The proposed grid connection route will require water crossings of unmapped watercourses at Ballinrea Cross and in the recently excavated area northwest of Shannon Park Roundabout. The unmapped watercourse at Ballinrea Cross discharges to the Owenboy River which in turn discharges into Owenboy Estuary pNHA and Cork Harbour SPA downstream. Along the N22, the proposed grid connection route is located within 10m of the Hilltown Stream which flows easterly parallel to the road, and discharges into Monkstown Creek pNHA and Cork Harbour SPA downstream.

3.2.4. Proposed Drainage Features and Pollution Control Measures

Subject to appropriate design specifications, the construction of the proposed substation and associated grid route will not give rise to increased surface water run-off in an agricultural setting. There is an existing network of drains within the site boundary of the solar farm, and these are fed by sloping topography. The sloping topography eliminates any potential for water ponding. The site drains naturally in a south-easterly direction.

Routine drainage inspection and maintenance will also be carried out at the Site as required. During the construction stage, any material or substance which could potentially cause pollution, including fuels or silty water will be prevented from entering groundwater, surface water drains or watercourses by the appropriate use of and temporary installation of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate. Settlement ponds will be used to minimise the risk of suspended solids, where necessary. Pollution control measures that may be implemented during the proposed amendment works are outlined below.

3.2.4.1. Silt Fences

Prior to the commencement of earthworks, silt fencing will be erected around the proposed substation site and within 50m of any water crossings along the GCR. This will be embedded into the ground and will be left in place throughout construction until all exposed soil has revegetated. Silt fences will also be installed around at locations where it is deemed necessary by the Site Supervisor/Construction Manager in consultation with the EHS Manager.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document '*Control of Water Pollution from Linear Construction Projects*' published by CIRIA (Ciria, No. C648, 1996). Silt fences will be embedded into the soil and supported by posts. A typical embedded silt fence is outlined in Plate 3-1 below.



Plate 3-1 Embedded Silt Fence

3.2.4.2. Cable Trench Drainage

Cable trenches are typically constructed in short, controlled sections thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage run-off to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded and backfilled with the appropriate materials before work on the next section commences.

To efficiently control surface water run-off from cable trench works areas, excavated material is stored on the up-gradient side of the trench and is temporarily sealed/smoothed-over using the back of the excavator bucket. Should any rainfall cause run-off from the excavated material, the material is collected and contained in the downgradient cable trench where it is allowed to percolate into the surrounding soil. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and in the case of the proposed development, will be either used for landscaping and reinstatements of areas on the site, reused as fill material for the trench, if appropriate, or removed to an appropriately licensed facility.

3.2.5. Prevention Pollution Control Measures

There are a number of existing watercourses and drainage ditches located within the site. Therefore, the proposed development will adopt General Pollution Prevention Measures to protect these watercourses and are listed below.

- Silt fencing will be installed between all proposed infrastructure and drainage ditches on site during the construction phase of the proposal;
- During any near stream construction work double silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase, as required;
- Plant will travel slowly across bare ground at a maximum of 5 km/hr;
- Any excess construction material shall be immediately removed from the area and sent to an authorised waste recovery facility;
- Where required, soils will be stripped to facilitate the installation of infrastructure such as the cabling associated with the grid route. A limited area of soils will be stripped at any one time to avoid exposing large areas of the proposed development area, thereby limiting rainfall infiltration and preventing run off onto exposed soil surfaces. Silt fencing will be installed around stripped areas, if required. Following reinstatement of each section, the area will be reseeded to facilitate immediate revegetation of the site and prevent suspended solids runoff;
- Stockpiles of potential excavated materials will be sealed with a digger bucket to reduce the

potential for sediment runoff. These areas will be surrounded with silt fencing, if required to prevent any pathway to any sensitive receptor. Polyethylene sheeting will also be placed over stockpiles as required;

- Whilst no significant silt laden run off is anticipated, the site will be regularly monitored by an onsite ECoW for signs of run-off such as silt in surrounding vegetation and measures will be put in place to prevent this where necessary. Silt fences will be installed around all drainage features.
- Minor excavations for the installation of cabling will be carried out using a suitably sized excavator and, in all circumstances, excavation depths and volumes will be minimised;
- Mobile storage tanks such as fuel bowsers will be bunded to 110% capacity to prevent spills. Tanks for bowsers and generators shall be double skinned. When not in use, all valves and fuel trigger guns from fuel storage containers will be locked;
- As construction advances there may be a requirement to collect and treat surface water within the proposed substation site or along the proposed GCR. This will be completed using perimeter swales at low points around the construction areas, and if required water will be pumped from the swales into sediment bags prior to overland discharge allowing water to percolate naturally to ground;
- If ground water is encountered during excavations, waters will be pumped from excavation and discharged through a pipe with a silt bag attached on to an area of overland vegetation within the site boundary.
- All plant refuelling will take place using mobile fuel bowsers. Only dedicated trained and competent personnel will carry out refuelling operations. A spill kit and drip tray shall be on site at all times and available for all refuelling operations. Equipment shall not be left unattended during refuelling. No refuelling shall take place within 50m of any watercourse. All pipework from containers to pump nozzles will have anti-siphon valves fitted. The plant refuelling procedures shall be detailed in the contractor's method statements.

The following mitigation measures will be implemented to eliminate the risk of negative effects on aquatic ecology from sediments and siltation during the construction phase of the proposed development:

- Site, surface drainage and silt control measures will be established prior to commencing earthworks, where required.
- Working practices will be controlled by, for example, minimising land take, avoiding repetitive handling of soils, minimising vehicle movements off-road and limiting the size of stockpiles to reduce the compaction and erosion of material
- Soils will be reinstated to their original locations where possible.
- Working near watercourses during intense rainfall events (>5 mm /hour) will be avoided and work will cease entirely near watercourses when it is evident that there is a threat of pollution occurring.
- Where possible, all excavated material will be removed to suitable stockpile areas. The volume of material to be managed is anticipated to be minor due to the nature and extent of cabling installation works.
- Stockpiling will be limited to areas where the ground is stable and well drained. Stockpiles will be located where the risk of soil erosion and water quality deterioration is minimal and will also have an adequate buffer (>10 m) from aquatic zones.
- Any water discharge from the stockpiles will be monitored. Runoff water will be prevented from flowing into a nearby excavation area or directly into nearby watercourses. Silt fences will be placed as required around stored excavated soils and other materials.

Specific stream crossing protection measures which will be implemented at the 2. No watercourse crossings are as follows:

- Timing of instream works should be carried out during the period of July 1st to September 30th to minimise potential adverse impacts to fisheries, in line with Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.
- An ecological clerk of works (Aquatic Ecologist) will be appointed to oversee cable laying

works at the stream crossings. This ecologist will oversee the protection of local fisheries habitats.

- Prior to instream works, electrofishing will be carried out in in the relevant stream under licence from the NPWS by a qualified ecologist to remove any fisheries from the works area and move them downstream of the proposed development site.
- Short sections of watercourses, where works are required, will then be temporarily dammed with sandbags at times of low water. One dam will be constructed immediately downstream of the section of watercourse to be crossed and another, immediately upstream. The flume will be installed at this time to allow continued flow from upstream to downstream. The dams, flumes, downstream silt traps and associated water protection measures will be manually installed by hand.
- Any remaining surface water within the dammed area will be pumped to a discharge point, a minimum of 30m from any watercourse and within the main construction site. It will pass through a silt bag before discharge to ground.
- The diameter of the flume pipe will be chosen to accommodate flows at the time with spare capacity to cover that predicted over the period that the works would be expected to last. Construction of the dam around the flume pipe will require use of small sandbags and possibly clay material to create a practical seal if needed. In this case the dam will be designed to reduce to a minimum the amount of clay to be used.
- To minimise the risk of in-stream habitat damage, all clean coarse surface material (Gravel, cobbles and boulders) on the bed of the river or stream to a depth of 20cm will be removed. A thinner layer will be removed if deeper material is mainly clay or sand. This will be set aside back from the watercourse and used to reinstate the stream bed after works have been completed.
- Material excavated from the trench will be placed on the level ground as far back from the watercourses as is practicable and surrounded on its downslope side by a silt-fence or dry- earth bund to prevent solids re-entering the stream. This material if deemed suitable can be used to partially backfill the trench.
- The riverbed substrate which was set aside will be used to reinstate the stream bed after the ducts have been installed and the flume pipe has been removed as well as all the damming materials.
- A silt fence will demarcate a 20-metre radius exclusion zone around the works area.
- Excavated watercourse material such as gravels and substrate will be stored in a designated area within the exclusion zone and surrounded by silt fencing. The excavated material will be removed and stored under the advice and supervision of an aquatic ecologist.
- No machinery will be permitted into the exclusion zone until the dams, flumes and protection measures are manually installed and functioning properly. There will be strictly no machinery works in or near the undammed watercourses.
- All machinery will be checked and cleaned at the temporary construction compound prior to entering the 20-metre exclusion zone.
- All excavated material associated with the underground cable will be safely stored on agricultural land outside the exclusion zone.
- Once the cable laying is complete, the riparian zones of all watercourses will be reinstated with stored material and new native vegetation planting. Once reinstated, the hydro morphology of these watercourses will be returned to its original state.

3.3. Refuelling, Fuel and Hazardous Materials Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Oils, fuel and all potentially harmful materials will be stored within an impermeable proprietary container.
- Mobile storage such as fuel bowsers will be bunded to prevent spills. Tanks for bowsers and generators shall be double skinned.

- No hazardous substance shall be permitted to be left unattended at any time when taken outside the bunded storage area.
- Potential impacts caused by spillages etc. during the construction phase will be reduced by keeping spill kits and other appropriate equipment on-site.
- All construction vehicles will be regularly checked and maintained prior to arrival at the site to prevent hydrocarbon leakage.
- Hoses and valves will be checked regularly for signs of wear and will be closed and securely locked when not in use.
- Only dedicated trained and competent personnel will carry out refuelling operations.
- A spill kit and drip tray shall be on site at all times and available for all refuelling operations.

3.4. Cement Based Products Control Measures

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered as needed, from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary with the washing directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plates 3-2 and 3-3 below.



Plate 3-2 Typical concrete wash out area



Plate 3-3 Concrete washout area

3.5. Dust Control

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, overburden, etc and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust.

Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at the entrance to the solar farm site. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be 'dampened down' during periods of dry weather.

If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.

3.6. Noise Control

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the site. It is expected that construction hours of operation will be between 08:00 and 18:00 Monday to Friday, and 08:00 and 16:00 on Saturday. No construction activities will

occur outside these hours unless agreed in writing with Cork County Council. Proposed measures to control noise include:

- Diesel generators, if utilised will be enclosed in sound proofed containers to minimise the potential for noise impacts;
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All construction plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations;
- Regular maintenance of plant will be carried out in order to minimise noise emissions.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works;
- Compressors, if required will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machines, which are used intermittently, will be shut down during those periods when they are not in use;
- Training will be provided by the Site EHS Manager to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.

The EHS Manager will be responsible for developing a noise and vibration monitoring plan for the duration of the construction period. This will involve carrying out regular noise and vibration monitoring on site as different activities progress to ensure compliance with the aforementioned mitigation measures.

If an environmental problem occurs on site that requires immediate attention direct communications between the Construction Manager and the Site EHS Manager will be conducted. The Site Manager will be responsible for following up on any noise complaints and for ensuring the noise limits set out in the planning conditions are adhered to. Refer also to Section 8.3 Corrective Action Procedure.

3.7. Archaeological Mitigation Measures

This section outlines the archaeological mitigation measures required to ensure compliance with Condition 8(i) of the planning permission and the recommendations provided in the Ballinrea 110kV Substation and Grid Connection Planning Environmental Considerations Report (PECR) - Archaeology and Cultural Heritage (Rubicon Heritage Services Ltd, June 2023).

> 8.(i) The Construction Environmental Management Plan (CEMP) shall include the location of any and all archaeological or cultural heritage contraints relevant to the proposed development as set out in Ballinrea 110kV Substation and Grid Connection Planning Evvironmental Considerations Report (PECR) - Archaeology and Cultural Heritage (Rubricon Heritaged Services Ltd dated June 2023) and by any subsequent archaeological investigations associated with the project. The CEMP shall clearly describe all indentified likely archaeological impacts, both direct and indriect, and all mitigation measures to be employed to protect the archaeological or cultural heritage environment during all phases of site preparation and construction activity.

The above report was revised in Oct 2024 following a programme of test trenching required for compliance with condition 8 b)of the permission – the final report along with the test trenching results was submitted to the NMS and to Cork County Council on 10th October 2024.

A preceding geophysical survey (for Ballinrea Solar Farm planning Ref. 17/06784) and subsequent targeted programme of archaeological test trenching (License No. 23E0323) identified a number of small, isolated pits (6 No.) and postholes (5 No.) within the footprint of the proposed 110kV substation at Ballinrea.

An *Archaeological Resolution Strategy Document to facilitate a 110kV Substation at Ballinrea Townland, Co. Cork* was submitted to Cork County Council on the 20th December 2024 which outlined the final mitigation strategy to be employed to protect the archaeological or cultural heritage environment during all phases of site preparation and construction activity as set out in section 3.7.2 below.

3.7.1. Potential Impacts

The proposed works do not impact any known monuments directly. However, the cable trench crosses the zone of notification for three RMP sites (CH014, CH019 & CH028). The excavation of trenches below the level of the subsoil, within the Zone of Notification, will have a negative and permanent indirect impact on features possible associated with these recorded monuments, which are afforded statutory protection under the National Monuments Act 1930-2014.

3.7.2. Mitigation Measures

The *Archaeological Resolution Strategy Document to facilitate a 110kV Substation at Ballinrea Townland, Co. Cork* submitted to Cork County Council on the 20th December 2024 proposes mitigation measures to ameliorate the potential impacts and the residual impact that the project will have on each site of cultural heritage significance and/or potential are provided below. The following mitigation measures proposed are subject to approval by the National Monuments Service and the local planning authority. They have been compiled with reference to the Framework and Principles for the Protection of the Archaeological Heritage (1999) as well as the following:

- *Environmental Protection Agency (2003) 'Advice notes on current practice (in the preparation of Environmental Impact Statements)'*
- *Environmental Protection Agency (2022) 'Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)'*
- *Department of Arts, Heritage, Gaeltacht and the Islands (DAHGI) (1999) 'Frameworks and Principles for the Protection of the Archaeological Heritage'*
- *Department of the Environment, Heritage and Local Government (2011) 'Architectural Heritage Protection Guidelines for Planning Authorities'*

The following mitigation measures are recommended:

It is now clear that it will not be feasible to preserve in situ, the isolated archaeological deposits identified during test trenching at the proposed substation location. These deposits comprised: 6 No(s). Possible Post Holes, and 5 No(s). Possible Pits.

The below resolution strategy is proposed in order to address Condition 8c It is proposed here that:

- The footprint of the proposed substation is mechanically stripped of topsoil under archaeological supervision and
- A programme of full archaeological excavation is undertaken, to ensure the preservation by record of the previously identified features. This work will be carried out by a team of suitably qualifiied archaeologists under licence and in accordance with the provisions of the National Monuments Acts 1930-2014
- Should archaeological features additional to those already-known deposits be discovered during the course of monitoring, a strategy will be proposed to the County Archaeologist and National Monuments Service for full archaeological excavation to ensure the preservation by record.

To facilitate the above, an application will be submitted to obtain a licence from the Department of Housing, Local Government and Heritage to undertake archaeological excavation. The total area proposed for stripping or topsoil will be 30,200 sq m approx. (corresponding the footprint of the proposed substation and associated compound). Archaeological monitoring and excavation will be undertaken in accordance with a submitted and approved method statement and the terms of a Licence to Excavate.

The results of any archaeological test trenching, monitoring, surveys and/or excavation will be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland Reports will be carried out in accordance with DAHLG Guidelines for Authors of Reports on Archaeological Excavations. The report will contain the following information where applicable to the results of the archaeological excavation programme:

- Description of the site and location
- Summary of the development and relevant planning background
- Relevant archaeological and historical background
- Objectives and methodology used
- Results of the test trenching programme
- Relevant discussion
- Relevant illustrations
    - Site location
    - RMP mapping
    - Historic mapping
    - Representative photos

o Scaled plans and drawings

The Licensed Director and/or Rubicon Heritage Services Ltd will issue the final report to the National Monuments Section of the Department of the Arts, Heritage and Gaeltacht and the National Museum of Ireland. A summary report will be published in the online Excavations Bulletin for 2024.

The archive generated by the work will be lodged with National Museum of Ireland, in approved format, once the facilities become available. The site archive and all materials recovered from the investigation will be temporarily housed in the Cork office of Rubicon Heritage Services Ltd.

The developer has appointed Rubicon Heritage to monitor groundworks on all previously undisturbed ground outside of the modern roadway (such as road verge or greenfield) under License Number 24E0662. Monitoring will also be undertaken under the same license where cable route cross the Zone of Notification for two RMP sites (CO086-062----& CO087-116----). Should archaeological features or deposits be discovered during the course of monitoring, the extent of such features/deposits will be determined, a GPS location of the site will be established and works at this location will cease. A strategy will be proposed to the County Archaeologist and National Monuments Service to preserve the site in situ, where possible. Where preservation in situ cannot be achieved, either in whole or in part, then a programme of full archaeological excavation will be proposed, to ensure the preservation by record of the portion of the site that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2014.

Where the proposed cable route passes the marked location of a Roadside Limekiln (ITM 57362, 564077), the cable trench will inspected by the monitoring archaeologist to ensure it is kept to the opposite (west) side of the carriageway to avoid impact on any sub-surface remains of this lime kiln. The results of any archaeological test trenching, monitoring, surveys and/or excavation will be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland.

The following mitigation measures outlined in Condition 8(f)(g) and (h) will also be adhered to:

> (f) A suitably qualified archaeologist shall be retained to advise on, and establish appropriate Exclusion Zones around the external-most elements of Vulnerable Heritage Assets as identified in Ballinrea 110kV Substation and Grid Connection Planning Environmental Considerations Report (PECR) - Archaeology and Cultural Heritage (Rubicon Heritage Services Ltd. Dated June 2023).
>
> (g) Exclusion Zones shall be fenced off or appropriately demarcated for the duration of the construction works in the vicinity of the monuments. The location and extent of each exclusion zone and the appropriate and the appropriate methodology for fencing off or demarcating each location shall be agreed in advance with the National Monuments Service and the Planning Authority.
>
> (h) No groundworks of any kind (including but not limited to advance geotechnical site investigations and no machinery, storage of materials or any other activity related to construction will be permitted within Exclusion Zones.

1)Appendix 5:

3.8. Invasive Species Management

During the multidisciplinary surveys carried out by MKO, a search for Invasive Alien Species (IAS), with a focus on those listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) was conducted by a suitably qualified ecologist. No invasive species were found on the site of the proposed substation however, Japanese Knotweed was identified at the northern boundary of the Ballinrea Solar Farm site, and a dedicated biosecurity plan and treatment programme have been prepared and will be submitted to Cork County Council along with the CEMP for Ballinrea Solar Farm. **Error! Reference source not found.**To prevent the introduction of any invasive species to the site best practice control methods are summarised in the following sections.

3.8.1. Site Management

There are no invasive species within the footprint of the substation or grid route however, in the event that an invasive species is encountered, an invasive species management plan will be prepared, and the following

measures will be adopted. Careful preparation of the site and planning of the works is crucial to successful prevention of introduction of invasive species. The following list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas.

3.8.2. Establishing Good Site Hygiene

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- Any soils or subsoils that is imported onto any site will be verified by a suitably qualified ecologist to be free from any invasive species listed on the 'Third Schedule' of Regulations 49 & 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I 477 of 2011). This will be carried out by searching for rhizomes and plant material.
- Any soils or subsoils contaminated with invasive species will be sent for disposal to an authorized waste facility.
- A suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species remedial works.

Plant and equipment which is operated within an area for the management of materials in contaminated areas will be decontaminated prior to relocating to a different works area. The decontamination procedures will take account of the following:

- Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it.
- Decontamination will only occur within designated wash-down areas.
- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g., wheel treads and arches.
- All run-offs will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

3.9. Construction Waste Management Plan

This section of the CEMP provides a Waste Management Plan (WMP) which outlines the best practice procedures during the construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage. Disposal of waste will be seen as a last resort.

This WMP has a number of key objectives as follows:

- To set out management prescriptions that adhere to a waste management hierarchy.
- To outline the roles and responsibilities of the Waste Manager.
- Prevention and minimisation of waste at the construction stage of the development.

3.9.1. Legislation

The Waste Management Act 1996 to 2011 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the proposed development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Environmental Protection Agency (EPA) provides a document entitled, 'Best Practice Guidelines on the Preparation of Resource & Waste Management Plans for Construction and Demolition Projects' (EPA, 2021). . It is important to emphasise that no demolition will take place at this site however, this document was referred to throughout the process of completing this WMP.

3.9.2. Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing waste in the following order:

Prevention and Minimisation:
The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:
Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:
There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

3.9.3. Construction Waste Management

The permitted development will involve the construction of a 110kV substation & grid connection and associated components. The substation will be constructed entirely within the confines of the Ballinrea Solar Farm site. The majority of the grid connection will be constructed in the public road corridor. The construction of the substation will comprise of a concrete foundation with concrete masonry blocks and a timber roof structure with roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The expected wastes arising from the amendment works including the individual List of Waste (LOW) codes are outlined in Table 3-1.

Table 3-1 Expected waste types arising during the construction phase

Materials type	Example	LOW Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05

Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, blocks, rock	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	Electrical fittings, PVC frames, ducting for cables	17 02 03
Plastic packaging	Packaging with new materials	15 01 02
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03
Soil & Stone	Soils and subsoils	17 05 04

Plant will not be serviced onsite or along the proposed grid connection route and so the likelihood of generating hazardous wastes is low. Hazardous wastes that may occur on site during the construction phase of the proposed development may include oil, diesel fuel, chemicals, paints, preservatives etc. Any hazardous wastes will be stored in bunded containers before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes so that contamination does not occur.

3.9.4. Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

- Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co- ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

3.9.5. Waste Arising from Construction Activities

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the Proposed Development site. Therefore, all wastes streams generated on site will be deposited into a single waste skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

Site personnel will be instructed at induction that under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.

3.9.6. Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Soils and subsoils will be reused as part of landscaping and site re-instatement

3.9.7. Recycling

If a certain type of construction material cannot be reused on site then recycling is the most suitable option.

All waste that is produced during the construction phase including dry recyclables will be sent directly for subsequent segregation at a remote facility. The low volume of such material that is anticipated to be generated at the proposed development is the justification for adopting this method of waste management.

3.9.8. Implementation

3.9.8.1. Roles and Responsibilities for Waste Management

Prior to the commencement of the proposed development a member of the on-site construction management staff will be assigned the role of Construction Waste Manager. The Construction Waste Manager will be in charge of the implementation of the objectives of the WMP, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the proposed development adheres to the WMP.

3.9.8.2. Training

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the WMP. All employees working on site during the construction phases of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery;
- Identify and liaise with waste contractors and waste facility operators.

3.9.8.3. Record Keeping

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site of the proposed development. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and LOW Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste

Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Weight of Material
- Site Address of Destination Facility

3.9.9. Waste Management Plan Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy should always be employed when designing the plan to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

This preliminary WMP has been prepared to outline the main objectives that are to be adhered to for the preparation of a more detailed WMP to be completed after the planning phase of the Proposed Development.

3.10. Ecology Management

The ecological survey for the proposed Ballinrea 110kV substation and grid connection identified the site as primarily agricultural grassland with hedgerows. A small section of hedgerow will need to be temporarily removed during construction, with reinstatement planned as per landowner requirements. Best practices, such as nesting season avoidance (March to August), will be followed to minimize impacts. While no Annex I habitats or protected species were recorded, curlew, black-headed gull, lapwing, and golden plover were observed occasionally foraging on-site. Mitigation measures were proposed to address potential indirect impacts on Cork Harbour SPA, including water quality protection and species disturbance management. These measures can be found in the sections below.

3.10.1. Ecological Protection Methods

The following measures have been outlined in the NIS and the EcIA submitted to support the planning application. These measures will be implemented as part of the proposed project in order to mitigate potential impacts on the existing ecology.

3.10.1.1. Measures

It is of paramount importance to minimise disturbance to flora and fauna whilst carrying out the construction works, and to ensure that disturbed habitats will regenerate quickly after completion of the works. The following general measures will be put in place, additional measures to protect the receiving environment during the enabling works and construction of the underground cable and joint bays are set out in **Section 2.5.2.6.3** of this CEMP. Measures for protection of aquatic environments are set out in **Section 3.2.4**

3.10.1.1.1. Site Set up

- Prior to the commencement of earthworks, Silt fencing will be installed between all proposed infrastructure and watercourses (streams, drainage ditches) on site during the construction phase of the proposed development. Where water crossings are required along the proposed GCR, double silt fences will be emplaced immediately down-gradient of the works area for the duration of the construction phase. Silt fences will be embedded into the ground and will be left in place throughout construction until all exposed soil has revegetated.
- The appointed contactor will be fully briefed by an ecologist as to the sensitive nature of the site and the required mitigation measures. A site compound will be established within the permitted Ballinrea solar farm site. The site

compound will be situated just south of the proposed substation location, as determined by the contractor, and will be positioned at least 50 meters away from any watercourses or waterbodies, as illustrated in Figure 12 below. The compound will be used for storage of material, machinery, fuel, and workers facilities.

- All construction materials and substances will be stored in the site compound.

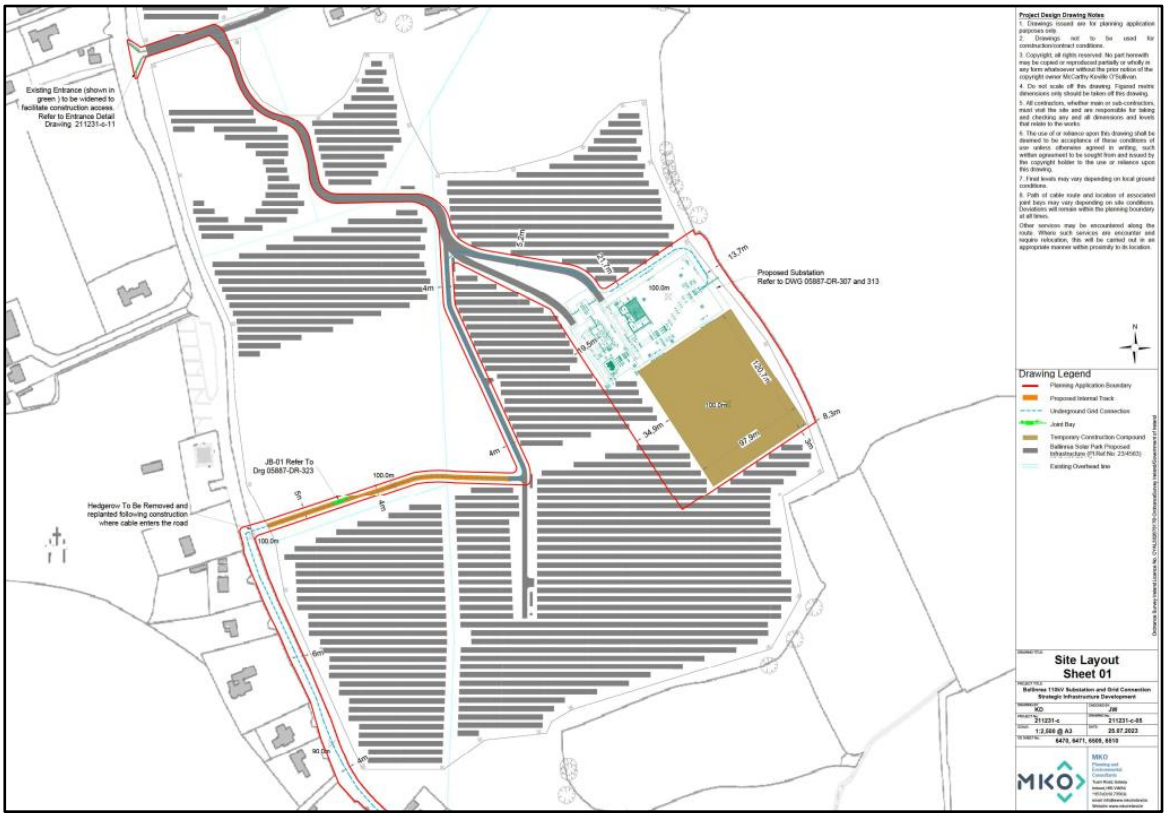


Figure 12- Location of proposed Site Compound

3.10.1.1.2. Environmental Monitoring

- The contractor will assign a member of the site staff as the environmental officer with the responsibility for ensuring the environmental measures prescribed in this document are adhered to. Any environmental incidents or non-compliance issues will immediately be reported to the project team.

3.10.1.1.3. Pollution Prevention

- Prior to the commencement of earthworks, silt fencing will be erected around the proposed substation site and within 50m of any water crossings along the GCR. This will be embedded into the ground and will be left in place throughout construction until all exposed soil has revegetated.
- Excavated spoil (if any) will be stockpiled and contained entirely within the confines of the site boundaries.
- During earthwork activities, the following mitigations will be adhered to:
    - Excavation depths will be kept to a minimum.
    - Material that is not re-used will be transported off site to a designated waste facility.
    - Suitable stone material will be imported to the site to be used as backfill.
    - Stockpiling of soil during construction, should it be required, will take place in designated areas within the site boundary away from any watercourses or waterbodies.
    - A silt fence will be erected around any stockpiling of material to prevent any sediment-laden run-off occurring.
    - All diesel or petrol pumps required onsite will be operated within bunded units.
    - Exposed surfaces will be re-vegetated as soon as possible following construction.
    - The minimum number of soil/subsoils and bedrock material will be removed from site. Soil may be reused for landscaping elsewhere on the site.
    - Where possible, earthworks will not be carried out during periods of heavy rainfall.

- As construction advances there may be a requirement to collect and treat surface water within the proposed substation site or along the proposed GCR. This will be completed using perimeter swales at low points around the construction areas, and if required water will be pumped from the swales into sediment bags prior to overland discharge allowing water to percolate naturally to ground;
- If ground water is encountered during excavations, waters will be pumped from excavation and discharged through a pipe with a silt bag attached on to an area of overland vegetation within the site boundary.
- Discharge to ground will be via a silt bag which will filter any remaining sediment from the
- pumped water;
- Daily monitoring and inspections of site drainage during construction will be completed by the appointed environmental officer;
- Good construction practices such wheel washers and dust suppression on site roads, and regular plant maintenance will ensure minimal risk. The Construction Industry Research and Information Association (CIRIA) provide guidance on the control and management of water pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRIA, 2001), which provides information on these issues. This will ensure that surface water arising during the course of construction activities will contain minimum sediment.

Cement Based Products

- No batching of wet-cement products will occur on site.
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place.
- Where possible, pre-cast elements for concrete works will be used.
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site.
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible.
- No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Use weather forecasting to plan dry days for pouring concrete. Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

Hydrocarbon Management

- All oils and solvents used during the construction phase will be stored within specially constructed, dedicated, bunded areas within the temporary site compound.
- Refuelling of construction vehicles and the addition of hydraulic oils to vehicles, will take place in a designated area in the temporary site compound, away from drainage ditches or other features that may transmit pollutants to surface waters.
- Spill kits and hydrocarbon adsorbent packs will be stored in the refuelling area and operators will be fully trained in the use of this equipment.

Sediments and siltation management

- Site, surface drainage and silt control measures will be established prior to commencing
- earthworks.
- Working practices will be controlled by, for example, minimising land take, avoiding repetitive handling of soils, minimising vehicle movements off-road and limiting the size of stockpiles to reduce the compaction and erosion of material.
- Soils will be reinstated to their original locations where possible.
- A buffer zone of 10 m or more will be established to protect any surface water channels, including drainage ditches, from disturbance from construction work.
- Working near watercourses during intense rainfall events (>5 mm /hour) will be avoided and work will cease entirely near watercourses when it is evident that there is a threat of pollution occurring.
- Where possible, all excavated material will be removed to suitable stockpile areas. The volume of material to be managed is anticipated to be minor due to the nature and extent of cabling installation works.
- Stockpiling will be limited to areas where the ground is stable and well drained. Stockpiles will be located where the risk of soil erosion and water quality

deterioration is minimal and will also have an adequate buffer (>10 m) from aquatic zones.
- Any water discharge from the stockpiles will be monitored. Runoff water will be prevented from flowing into a nearby excavation area or directly into nearby watercourses. Silt fences will be placed as required around stored excavated soils and other materials.

Waste Management

- All waste will be collected in skips and the site will be kept tidy and free of debris at all times.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or recycling.
- All construction waste materials will be stored within the confines of the site, prior to removal from the site to a permitted waste facility.

3.10.1.1.4. Horizontal Directional Drilling

- Horizontal Directional Drilling (HDD) is required for the grid connection to pass a bridge due to insufficient cover for cables within the bridge itself. It is proposed to launch the HDD from private land. The HDD will not be going under the bridge but will launch parallel to it and will be used to get past the bridge and back into the road. The proposed drilling methodology is taken from the Outline Construction Methodology prepared by TLI and submitted as part of the consented application;

  - Work areas will be fenced on both sides of the HDD.
  - The launch pit will be located in private land adjacent to Fernhill Road.
  - The receive pit will be located on Fernhill Road which will require a road closure for the works.
  - The drilling rig and fluid handling units located on one side of the crossing will be stored on double bunded 0.5mm PVC bunds which will contain any accidental fluid spills and storm water run-off.
  - Entry and exit pits (1m x 1m x 2m) will be excavated; the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
  - A 1m x 1m x 2m steel box will be placed in each pit. This box will capture any drilling fluid returns from the borehole.
  - The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the stream-ways and the forestry.
  - A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
  - The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
  - Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
  - When all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
  - The steel boxes will be removed, and the drilling fluid disposed of to a licensed facility.
  - The ducts will be cleaned and proven and their installed location surveyed.
  - The entry and exit pits will be reinstated as per the landowners' requirements.
  - A typical HDD would take 3 days. This is dependent on a number of factors such as ground conditions, geology, etc. and would be taken into account during design stage by the HDD contractor.

3.10.2. Landscaping, Planting and Reinstatement

Landscaping and planting efforts will align with the approved plans for the site, incorporating measures to restore and enhance the local ecology. Reinstatement works will include the replacement of removed hedgerows using native species such as hawthorn, ash, and elder to maintain biodiversity.

Approximately 8 meters of hedgerow temporarily removed during construction will be replanted or enhanced,

with additional boundary planting to reinforce ecological corridors. Reinstatement will include native grass seed application in disturbed areas and the management of any invasive species identified during surveys, such as Japanese Knotweed, to ensure long-term ecological stability. The approach will follow best practices, including adherence to seasonal restrictions for vegetation removal, avoiding nesting season (March to August), to protect wildlife during construction.

3.10.3. Archaeological Protection and Supervision

All groundworks associated with the 110kV Substation and Grid project will be conducted under the supervision of a licensed archaeologist to ensure compliance with planning conditions and the preservation of cultural heritage. Pre-construction archaeological testing has identified several isolated pits and postholes within the footprint of the proposed substation at Ballinrea, as well as 10 Areas of Archaeological Potential and other cultural heritage sites along the grid connection route.

Mitigation measures will include the establishment of exclusion zones around identified features, which will be appropriately fenced or demarcated. In respect of the archaeological exclusion zones to be set out, the developer has appointed Rubicon Heritage to liaise with the Local Authority archaeologist and establish the previously agreed buffer zones prior to the commencement of construction. No construction-related activities, including machinery movement or material storage, will occur within these zones. In the event of significant archaeological discoveries, works in the area will be paused, and a mitigation strategy—such as preservation in situ, excavation, or recording—will be implemented in consultation with the National Monuments Service.

Regular archaeological monitoring will take place during trenching, excavation, and installation activities along the grid connection route. A final report detailing the findings and any mitigation measures undertaken will be submitted to the planning authority and relevant bodies upon completion. All works will adhere to the recommendations set out in the archaeological assessments and planning conditions, ensuring the protection of the region's cultural and historical assets.

4. ENVIRONMENTAL MANAGEMENT IMPLEMENTATION

4.1. Roles and Responsibilities

The main contractor appointed to carry out the works on site will be required to provide a level of supervision on site in the form of an EHS Manager who will also fulfil the role of Waste Manager. In general, the EHS Manager will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The EHS Manager will act as the regulatory interface on environmental matters by reporting directly to the client and liaising with Cork County Council and other statutory bodies as required.

4.2. Construction Manager/Site Supervisor

The Construction Manager/Site Supervisor will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the Project CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;
- Be aware of the relevant legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,

- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

4.2.1. Environmental Manager

The main contractor appointed to carry out the works on site will be required to provide a level of supervision by the Site Manager, who will also fulfil the role of EHS Manager and Waste Manager and maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. Alongside the Site Manager, an external Ecological Clerk of Works (ECoW) will visit site on a regular basis, as required, to ensure construction projects comply with environmental regulations, protect biodiversity, monitor ecological impacts, and provide guidance to minimising environmental risks.

The Site Manager and the ECoW will act as the regulatory interface on environmental matters by reporting directly to the client and liaising with Cork County Council and other statutory bodies as required. Due to the scale of activity proposed for the site, this role can be adopted by a Site Manager/Foreman as part of their duties. The environmental duties of the appointed Site Manager/ are summarised as follows:

- Maintain and update as required the Construction Phase CEMP and supporting environmental documentation and review/approval of contractor method statements.
- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period.
- Advise site management/contractor/sub-contractors on:
  - *Prevention of environmental pollution and improvement to existing working methods.*
  - *Changes in legislation and legal requirements affecting the environment.*
  - *Suitability and use of plant, equipment and materials to prevent pollution.*
  - *Environmentally sound methods of working and systems to identify environmental hazards.*
- Ensure proper mitigation measures are initiated and adhered to during the construction phase.
- Liaise with Project Team and present the findings of site audits/inspections that are completed.
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents.
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by email.
- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties.
- Identify environmental training requirements and arrange relevant training for all levels of site-based staff/workers;
- Fulfil the role of Waste Manager and implement the objectives of the Waste Management Plan as set out in Section 3 above.

4.2.1.1. Environmental Clerk of Works (ECoW)

The Site Ecologist will be a fully qualified and suitably experienced Ecologist, who will be responsible for the following:

- Visit the site at regular intervals pre and during construction works to implement the ecological monitoring requirements under An Bord Pleanála conditions as required.
- Undertake a pre-construction survey to identify any environmental constraints that could impact construction works (for example Badger setts/invasive species location etc)
- Ensure the appropriate onsite ecological monitoring & management throughout the construction phase of Ballinrea Solar project.
- Conduct a full review of all the relevant ecological documents and inclusion of relevant information in reports and ensure adherence.
- Ensure appropriate on-site ecological direction to the Owners Engineer (OE) to ensure

application of all aspects of the CEMP, its management prescriptions, and protocols throughout the development of Ballinrea Solar project for the duration of the contract.

- Implement the environmental monitoring requirements of the CEMP.
- Provide site inspection/audits report on a routine basis to the OE.
- Provide updated environment incident reports to the OE, other relevant staff, and the client, if required.
- Implement and appropriately manage the Biodiversity Plan/Landscape plan if required
- Implement and appropriately manage the Surface Water Management/Water Quality Management/Spoil Management/Waste Management as part of the CEMP.
- Ensure adherence to any invasive species management/biosecurity plan onsite.
- Attend Workshops/Site Induction days, Toolbox Talks, as necessary.
- The Site Ecologist will have a number of responsibilities during the pre-construction, construction and operational e.g. pre-construction and surveys advisory role, reporting etc. outlined in detail within the EIS, NIS, HMP & CEMP
- Consultation with the Local Authorities, National Parks and Wildlife Service (NPWS), Inland Fisheries Ireland (IFI) and statutory bodies as required.
- Provide support and guidance for the OE with respect to ecological protection and preservation on site.
- Review the Contractors Method Statements with respect to ecological protection.
- Visit the site at relevant intervals during construction to implement the ecological monitoring requirements under An Bord Pleanála planning permission (once site set-up is complete, bi-monthly (twice per month site inspections are proposed)

5. EMERGENCY RESPONSE PLAN

5.1. Emergency Response

The Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection. The site ERP includes details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP will require updating and submissions from the contractor/PSCS and suppliers as the project progresses. Where sub-contractors that are contracted on site are governed by their own emergency response procedure a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's ERP within this document.

This is a working document that requires updating throughout the various stages of the project.

5.1.1. Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 5-1. In a situation where the Site Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in Figure 5-1. This will be updated throughout the various stages of the project.

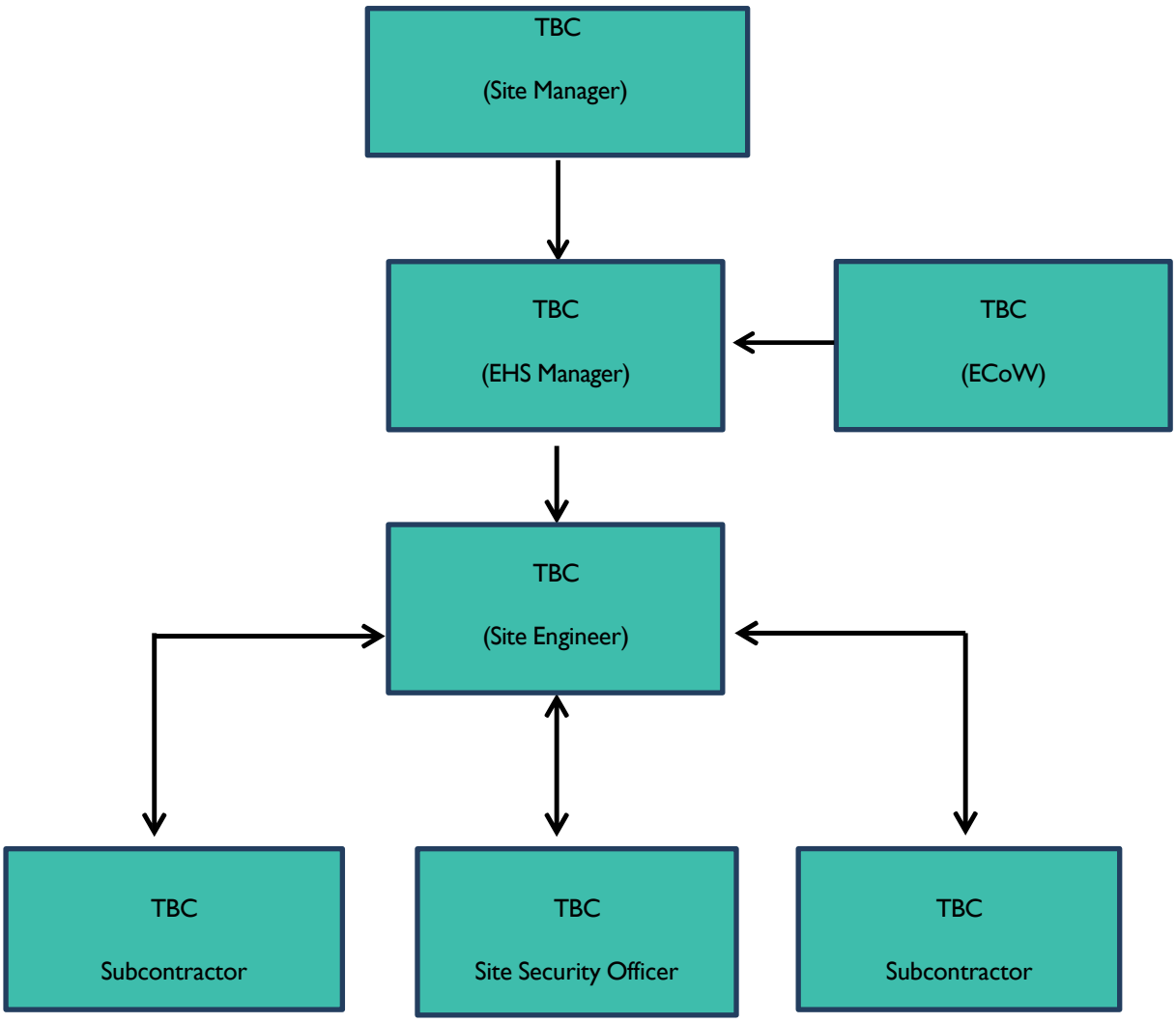


Figure 5-1 Emergency Response Procedure Chain of Command.

5.1.2. Initial Steps

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require and emergency response in the event of an occurrence.

Table 5-1 Hazard Associated with Potential Emergency Situations

Hazard	Emergency Situation
Construction Vehicles: Dumpers, tractors, excavators, etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools.
Contact with services.	Electrical shock or gas leak associated with an accidental breach of underground services.
Fire	Injury to operative through exposure to fire.
Falls from heights including falls from scaffold towers, scissor lifts, ladders and roofs.	Injury to operative after a fall from a height.

Sickness	Illness unrelated to site activities of an operative e.g., heart attack, loss of consciousness, seizure.

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 5-1 the Site Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/foghorn that activates an emergency evacuation on the site.
- Make safe the area if possible and ensure that there no identifiable risk exists with regard to dealing with the situation e.g., if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to another person of responsibility. If delegating the task, ensure that they follow the procedures for contacting the emergency services as set out in Section 5.2.2
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g., cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g., ESB Networks the numbers for which as provided in Section 5.2.2
- Contact the next of kin of any injured personnel where appropriate. The procedure for this is outlined in Section 5.2.3.

5.1.3. Site Evacuation/ Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or foghorn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Manager when all personnel have been accounted for. At this time the Site Manager will decide the next course of action which will be determined by the situation that exists at that time. The Site Manager will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills

5.1.4. Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the proposed project. Oil/Fuel spillages are one of the main environmental risks that will exist on the site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident.

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.

- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the EHS Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The EHS Manager will inspect the site and will assist by providing any advice possible to ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The Construction Manager will notify the appropriate regulatory body such as Cork County Council and Environmental Protection Agency (EPA) etc. if deemed necessary.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The EHS Manager must be immediately notified.
- If necessary, the EHS Manager will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures that were used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site, (pSPA or cSAC), the EHS Manager will liaise with an Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the EHS Manager will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the EHS Manager and the Main Contractor. These records will be made available to the relevant authorities such as Cork County Council and the EPA if required.

The EHS Manager will be responsible for any corrective actions required as a result of the incident e.g., an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate

5.2. Contacting the Emergency Services

5.2.1. Emergency Communication Procedure

In the event of requiring the assistance of the emergency services the following steps should be taken:

- **Stay calm**. It is important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.
- **Know the location of the emergency and the number you are calling from**. This may be asked and answered a couple of times but do not get frustrated. Even though many emergencies call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for some reason you are disconnected, at least emergency crews will know where to go and how to call you back.
- **Wait for the call-taker to ask questions, then answer clearly and calmly**. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.
- **If you reach a recording, listen to what it says**. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When

the next call-taker or dispatcher is available to take the call, it will transfer you.

- **Let the call-taker guide the conversation**. He or she is typing the information into a computer and may seem to be taking forever. There is a good chance, however, that emergency services are already being sent while you are still on the line.
- **Follow all directions**. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you do not understand.
- **Keep your eyes open**. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.
- **Do not hang up the call** until directed to do so by the call taker.

All staff members will know the address and location of the site as it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.

5.2.2. Contact Details

A list of emergency contacts is presented in Table 5-2. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 5-2 Emergency Contacts

Hazard	Emergency Situation
Emergency Services – Ambulance, Fire, Gardaí	999/112
Doctor – Cork City Medical Centre	021 422 2424
Hospital – Cork University Hospital	021 454 6400
ESB Emergency Services	1850 372 999
Bórd Gais Emergency	1850 20 50 50
Gardaí – Carrigaline Garda Station	021 491 9370
Health and Safety Coordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDS): TBC	TBC
Client – Orsted	021 422 3600

5.2.3. Procedure for Personnel Tracking

All operatives on site without any exception will have to undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative becoming involved in an emergency situation where serious injury has occurred, and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

5.2.4. Induction Checklist

Table 4-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 5-3 Emergency Response Plan Items Applicable to the Site Induction Process

ERP Items to be included in Site Induction	Status
All personnel will be made aware of the evacuation procedure during site induction.	
Due to the location and layout of the site, it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.	
All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

6. MITIGATION PROPOSALS

The Mitigation Measures which will be implemented are presented in this section of the CEMP. The CEMP will be updated prior to construction and will include all relevant planning conditions as detailed in section 2.3.

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project

Table 6-1 Mitigation Measures

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		Pre-Commencement Phase		
EHS Manager				
1	CEMP Section 4.1	The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in construction to fulfil the role of EHS Manager, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.		
Archaeological Measures				
2	CEMP Section 3.7.2	It is now clear that it will not be feasible to preserve in situ, the isolated archaeological deposits identified during test trenching at the proposed substation location. These deposits comprised: 6 No(s). Possible Post Holes, and 5 No(s). Possible Pits. The below resolution strategy is proposed in order to address Condition 8c It is proposed here that: • The footprint of the proposed substation is mechanically stripped of topsoil under archaeological supervision and • A programme of full archaeological excavation is undertaken, to ensure the preservation by record of the previously identified features. This work will be carried out by a team of suitably qualifiied archaeologists under licence and in accordance with the provisions of the National Monuments Acts 1930-2014 • Should archaeological features additional to those already-known deposits be discovered during the course of monitoring, a strategy will be proposed to the County Archaeologist and National Monuments Service for full archaeological excavation to ensure the preservation by record.		
		Construction Phase		

Construction Management				
3	CEMP Section 3.2.4	Routine drainage inspection and maintenance will also be carried out at the as required. During the construction stage, any material or substance which could potentially cause pollution, including fuels or silty water will be prevented from entering groundwater, surface water drains or watercourses by the appropriate use of and temporary installation of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate. Settlement ponds will be used to minimise the risk of suspended solids, where necessary. Pollution control measures that may be implemented during the proposed amendment works are outlined below.		
4	CEMP Section 3.2.4.1	Silt fencing will be installed between all proposed infrastructure and drainage ditches and watercourses on site during the construction phase of the proposed development. Silt fences will also be installed around at locations where it is deemed necessary by the Site Supervisor/Construction Manager in consultation with the EHS Manager.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document '*Control of Water Pollution from Linear Construction Projects*' published by CIRIA (Ciria, No. C648, 1996). Silt fences will be embedded into the soil and supported by posts.		
5	CEMP Section 3.2.4.2	To efficiently control surface water run-off from cable trench works areas, excavated material is stored on the up-gradient side of the trench and is temporarily sealed/smoothed-over using the back of the excavator bucket. Should any rainfall cause run-off from the excavated material, the material is collected and contained in the downgradient cable trench where it is allowed to percolate into the surrounding soil. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and in the case of the proposed development, will be either used for landscaping and reinstatements of areas on the site, reused as fill material for the trench, if appropriate, or removed to an appropriately licenced facility.		
Surface Water Mitigation				
6	CEMP Section 3.2.5	› Silt fencing will be installed between all proposed infrastructure and drainage ditches on site during the construction phase of the proposal; › During any near stream construction work double silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase; › Plant will travel slowly across bare ground at a maximum of 5 km/hr; › Excess construction material will be utilised for landscaping and revegetation unless contaminated, wherebyconstruction material shall be immediately removed from the area and sent to an authorised waste disposal facility; › Where required, soils will be stripped to facilitate the installation of infrastructure such as the cabling associated with the grid route. A limited area of soils will be stripped at any one time to		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		avoid exposing large areas of the proposed development area, thereby limiting rainfall infiltration and preventing run off onto exposed soil surfaces. Silt fencing will be installed around stripped areas, if required. Following reinstatement of each section, the area will be reseeded to facilitate immediate revegetation of the site and prevent suspended solids runoff; › Stockpiles of potential excavated materials will be sealed with a digger bucket to reduce the potential for sediment runoff. These areas will be surrounded with silt fencing, if required to prevent any pathway to any sensitive receptor. › Whilst no significant silt laden run off is anticipated, the site will be regularly monitored by the EHS Manager for signs of run-off such as silt in surrounding vegetation and measures will be put in place to prevent this where necessary. Silt fences will be installed around all drainage features. › Minor excavations for the installation of cabling will be carried out using a suitably sized excavator and, in all circumstances, excavation depths and volumes will be minimised; › Mobile storage tanks such as fuel bowsers will be bunded to 110% capacity to prevent spills. Tanks for bowsers and generators shall be double skinned. When not in use, all valves and fuel trigger guns from fuel storage containers will be locked; › All plant refuelling will take place using mobile fuel bowsers. Only dedicated trained and competent personnel will carry out refuelling operations. A spill kit and drip tray shall be on site at all times and available for all refuelling operations. Equipment shall not be left unattended during refuelling. All pipework from containers to pump nozzles will have anti siphon valves fitted. The plant refuelling procedures shall be detailed in the contractor's method statements.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		The following mitigation measures will be implemented to eliminate the risk of negative effects on aquatic ecology from sediments and siltation during the construction phase of the proposed development: › Site, surface drainage and silt control measures will be established prior to commencing earthworks, where required. › Working practices will be controlled by, for example, minimising land take, avoiding repetitive handling of soils, minimising vehicle movements off-road and limiting the size of stockpiles to reduce the compaction and erosion of material › Soils will be reinstated to their original locations where possible. › Working near watercourses during intense rainfall events (>5 mm/hour) will be avoided and work will cease entirely near watercourses when it is evident that there is a threat of pollution occurring. › Where possible, all excavated material will be removed to suitable stockpile areas. The volume of material to be managed is anticipated to be minor due to the nature and extent of cabling installation works. › Stockpiling will be limited to areas where the ground is stable and well drained. Stockpiles will be located where the risk of soil erosion and water quality deterioration is minimal and will also have an adequate buffer (>10 m) from aquatic zones. › Any water discharge from the stockpiles will be monitored. Runoff water will be prevented from flowing into a nearby excavation area or directly into nearby watercourses. Silt fences will be placed as required around stored excavated soils and other materials.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		Specific stream crossing protection measures which will be implemented at the 2. No watercourse crossings are as follows: › Timing of instream works will be carried out during the period of July 1st to September 30th to minimise potential adverse impacts to fisheries, in line with Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters. › An ecological clerk of works (Aquatic Ecologist) will be appointed to oversee cable laying works at the stream crossings. This ecologist will oversee the protection of local fisheries habitats. › Prior to instream works, electrofishing will be carried out in in the relevant stream under licence from the NPWS by a qualified ecologist to remove any fisheries from the works area and move them downstream of the proposed development site. › Short sections of watercourses, where works are required, will then be temporarily dammed with sandbags at times of low water. One dam will be constructed immediately downstream of the section of watercourse to be crossed and another, immediately upstream. The flume will be installed at this time to allow continued flow from upstream to downstream. The dams, flumes, downstream silt traps and associated water protection measures will be manually installed by hand. › Any remaining surface water within the dammed area will be pumped to a discharge point, a minimum of 30m from any watercourse and within the main construction site. It will pass through a silt bag before discharge to ground. › The diameter of the flume pipe will be chosen to accommodate flows at the time with spare capacity to cover that predicted over		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		the period that the works would be expected to last. Construction of the dam around the flume pipe will require use of small sandbags and possibly clay material to create a practical seal if needed. In this case the dam will be designed to reduce to a minimum the amount of clay to be used. › To minimise the risk of in-stream habitat damage, all clean coarse surface material (Gravel, cobbles and boulders) on the bed of the river or stream to a depth of 20cm will be removed. A thinner layer will be removed if deeper material is mainly clay or sand. This will be set aside back from the watercourse and used to reinstate the stream bed after works have been completed. › Material excavated from the trench will be placed on the level ground as far back from the watercourses as is practicable and surrounded on its downslope side by a silt-fence or dry-earth bund to prevent solids re-entering the stream. This material if deemed suitable can be used to partially backfill the trench. › The riverbed substrate which was set aside will be used to reinstate the stream bed after the ducts have been installed and the flume pipe has been removed as well as all the damming materials. › A silt fence will demarcate a 20-metre radius exclusion zone around the works area. › Excavated watercourse material such as gravels and substrate will be stored in a designated area within the exclusion zone and surrounded by silt fencing. The excavated material will be removed and stored under the advice and supervision of an aquatic ecologist. › No machinery will be permitted into the exclusion zone until the dams, flumes and protection measures are manually installed and functioning properly. There will be strictly no machinery works in or near the undammed watercourses.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		› All machinery will be checked and cleaned at the temporary construction compound prior to entering the 20-metre exclusion zone. › All excavated material associated with the underground cable will be safely stored on agricultural land outside the exclusion zone. › Once the cable laying is complete, the riparian zones of all watercourses will be reinstated with stored material and new native vegetation planting. Once reinstated, the hydro morphology of these watercourses will be returned to its original state.		
Fuel and Oil Control				
7	CEMP Section 3.3	› Oils, fuel and all potentially harmful materials will be stored within an impermeable proprietary container. › Mobile storage such as fuel bowsers will be bunded to prevent spills. Tanks for bowsers and generators shall be double skinned. › No hazardous substance shall be permitted to be left unattended at any time when taken outside the bunded storage area. › Potential impacts caused by spillages etc. during the construction phase will be reduced by keeping spill kits and other appropriate equipment on-site. › All construction vehicles will be regularly checked and maintained prior to arrival at the site to prevent hydrocarbon leakage. › Hoses and valves will be checked regularly for signs of wear and will be closed and securely locked when not in use. › Only dedicated trained and competent personnel will carry out refuelling operations.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		› A spill kit and drip tray shall be on site at all times and available for all refuelling operations.		
Cement Based Products Control Measures				
	CEMP Section 3.4	› No batching of wet-cement products will occur on site; › The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures. › Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used; › No washing out of any plant used in concrete transport or concreting operations will be allowed on-site; › Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. › Use weather forecasting to plan dry days for pouring concrete; › Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event; › The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.		
Dust Control				
8	CEMP Section 3.5	Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, overburden, etc and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust. Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at site access points. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be 'dampened down' during periods of dry weather. If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.		
Noise Control				
9	CEMP Section 3.6	› Diesel generators, if utilised will be enclosed in sound proofed containers to minimise the potential for noise impacts; › Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All construction plant and equipment to be used on-site will be modern equipment and will		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations; › Regular maintenance of plant will be carried out in order to minimise noise emissions. › All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works; › Compressors, if required will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; › Machines, which are used intermittently, will be shut down during those periods when they are not in use; › Training will be provided by the Site EHS Manager to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.		
Traffic Management				
10	CEMP Section 2.6	› Warning signs / Advanced warning signs will be installed at appropriate locations in advance of the construction site access locations. › Construction and delivery vehicles will be instructed to use only the approved and agreed means of access and egress; and movement of construction vehicles will be restricted to these designated routes. › Appropriate vehicles will be used to minimise environmental impacts from transporting construction material, for example the use of dust covers on HGVs carrying dust producing material. › Speed limits of construction vehicles to be managed by appropriate signage, to promote low vehicular speeds.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		› Parking of site vehicles will be managed and will not be permitted on public road, unless proposed within a designated area that is subject to traffic management measures and agreed with Cork County Council. › A road sweeper will be employed, if necessary, to clean the public roads of any residual debris that may be deposited on the public roads leading away from the construction works. › On site wheel washing will be undertaken for construction vehicles to remove any debris prior to leaving the site. › All vehicles will be suitably serviced and maintained to avoid any leaks or spillage of oil, petrol or diesel. All scheduled maintenance will not be carried out on the public highway.		
Invasive Species Management				
11	CEMP Section 3.8	› A risk assessment and method statement must be provided by the Contractor prior to commencing works. › Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected. › A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface. › Stockpile areas will be chosen to minimise movement of contaminated soil. › Stockpiles will be marked and isolated. › Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		› The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material. › Any material that is imported onto any site will be verified by a suitably qualified ecologist to be free from any invasive species listed on the 'Third Schedule' of Regulations 49 & 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I 477 of 2011). This will be carried out by searching for rhizomes and plant material. › Any soils or subsoils contaminated with invasive species will be sent for disposal to an authorized waste facility. › A suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species remedial works. Plant and equipment which is operated within an area for the management of materials in contaminated areas will be decontaminated prior to relocating to a different works area. The decontamination procedures will take account of the following: › Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it. › Decontamination will only occur within designated wash-down areas. › Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g., wheel treads and arches. › All run-offs will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.		
Waste Management				

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
12	CEMP Section 3.9	Appropriate measures should be taken to ensure excess waste is not generated during construction, including; › Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock. › Purchase of materials pre-cut to length to avoid excess scrap waste generated on site. › Request that suppliers use least amount of packaging possible on materials delivered to the site. › Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal › Ensuring correct sequencing of operations. › Use reclaimed materials in the construction works.		

7. PROGRAMME OF WORKS

7.1. Construction Programme

The construction phase will take approximately 23 months to complete. The construction of the proposed development consisting of the 110kV substation & grid route connection can be broken down into a number of stages. An example of the programme of works is outlined in Table 7-1 below. The construction programme will be finalised on appointment of a contractor before commencement of the development.

Table 7-1 Phasing Scope of Works

Phase No.	Description	Scope of works
Phase 1	Site Setup	This occurs from months 1 to 3 and includes laying the matting or gravel for the site setup and machinery mobilisation.
Phase 2	Site Roads	This occurs from months 4 to 6 and includes the installation of new site roads along with upgrades required.
Phase 2	Substation Construction	This occurs from months 6 to 12. It includes installation of hardcore areas, foundations and the construction of the substation building and all associated components.
Phase 3	Electrical Works	All electrical works within the substation compound will be carried out at this stage. These works will be carried out from months 12 to 18
Phase 3	Grid Route and Associated Cabling	The grid connection and associated works will be carried out at this phase. These works will be carried out from months 18 to 20.
Phase 6	Commissioning	The final phase of the project will involve the commissioning of the substation and grid connection. The commissioning will be carried out from months 20 to 23.

8. COMPLIANCE AND REVIEW

8.1. Site Inspections and Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Site EHS Manager and the Construction Manager to ensure all controls to prevent potential environmental impacts, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this Construction & Environmental Management Plan and any consent conditions. Only suitably trained staff will undertake environmental site inspections.

8.2. Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the Solar Farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the CEMP.

8.3. Corrective Action Procedure

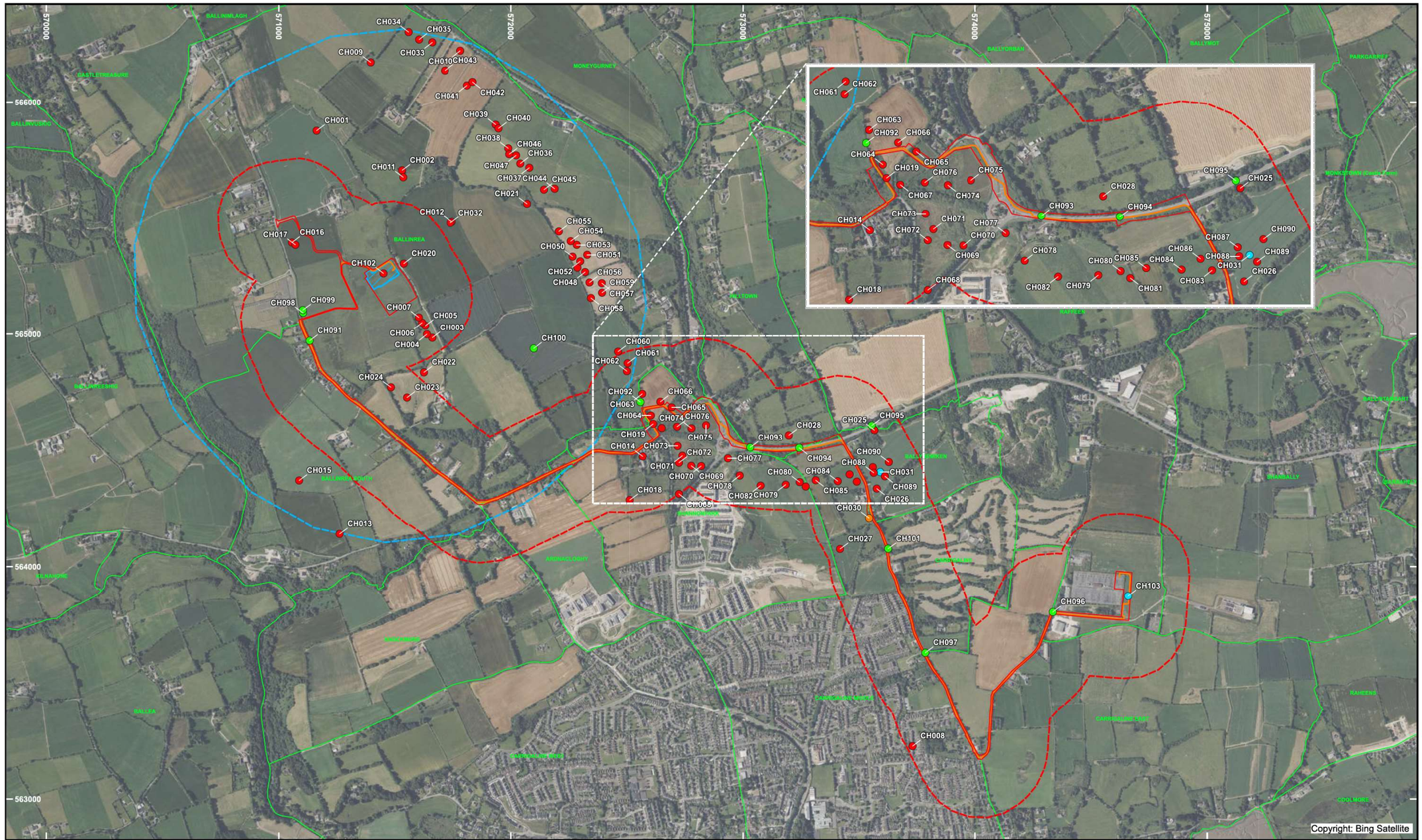
A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Construction Manager, as advised by the Site EHS Manager.
Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Construction Manager and the Site EHS Manager will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

Appendix 1: Figure showing location of Cultural Heritage Sites within development footprint.



Rubicon Heritage

Key:

- Underground Grid Connection
- Planning Application Boundary
- Grid Connection Cable Study Area
- Proposed Substation
- Proposed Substation Study Area

CH Site_Baseline Value

- Very High
- High
- Medium/ Low
- Low
- Townland Boundary

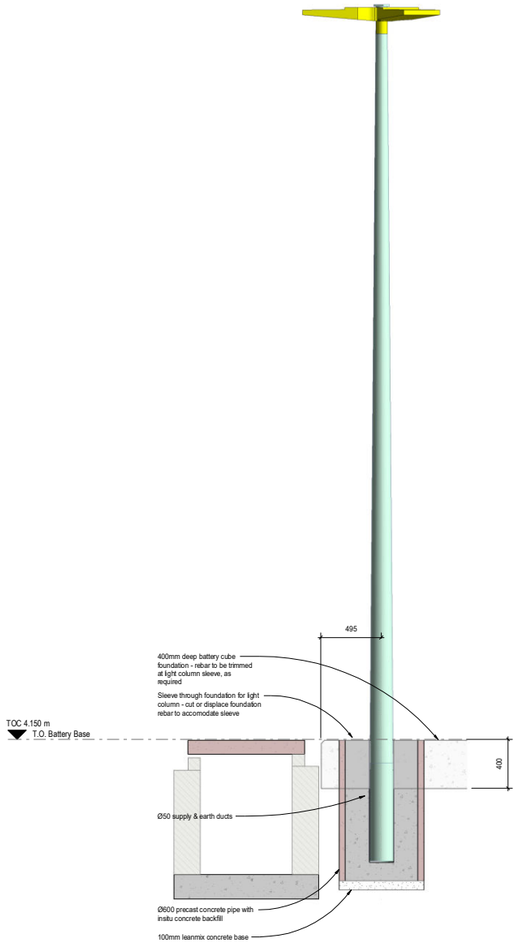
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0 160 320 480 640 800 m

Project: Ballinrea-Rafeen Connection Route	
Date: 13/09/2024	Prepared by: H.Sims
Scale: 1:16,000 @ A3	Approved by: E. O'Flaherty
Status: Final	Revision Number: 1.9

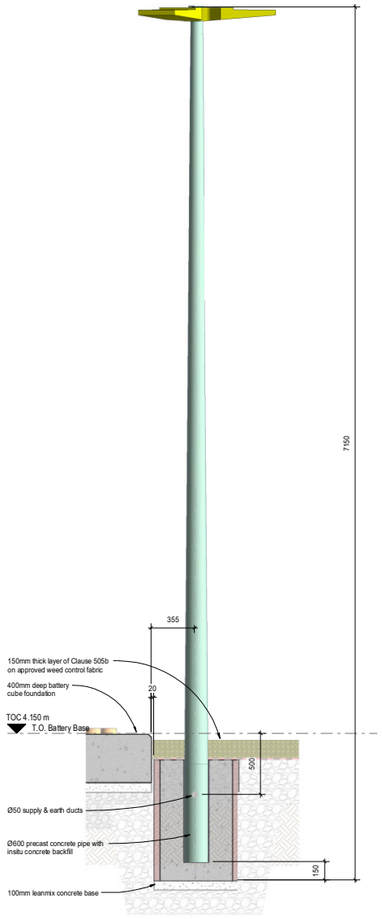
Figure 2 - Cultural Heritage sites within the proposed development study area.

Appendix 2: Cork Lighting Scheme – Drawing



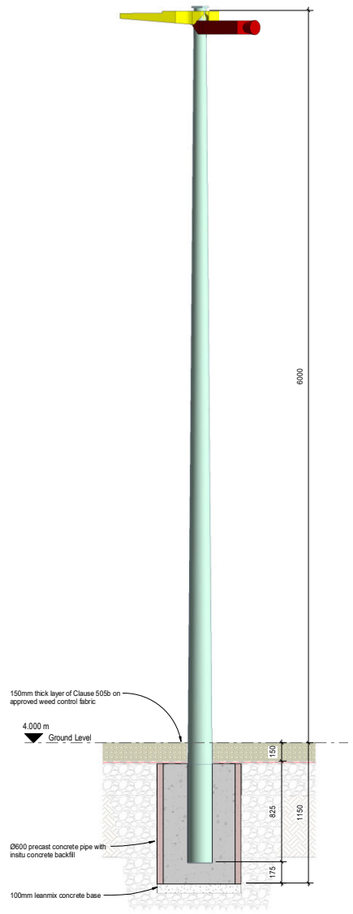
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SECTION LC.2

SCALE: 1 : 25



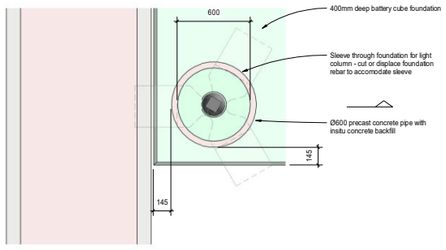
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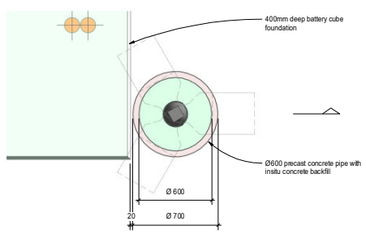
Light & CCTV Column

SCALE:



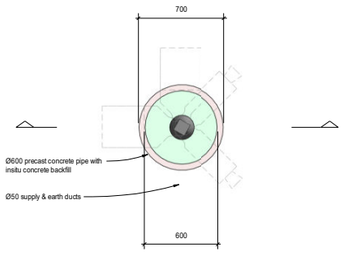
PLAN - Light Column LC.1

SCALE: 1 : 25



PLAN - Light Column LC.2

SCALE: 1 : 25



PLAN - Light Column LC.3

SCALE: 1 : 25

NOTES

- All Dimensions are in millimetres (unless noted otherwise).
- Drawings are not to be scaled.
- All drawings are to be read in conjunction with the relevant Civil/Structural specification and all other relevant contract documentation.
- Any discrepancies between these documents shall be brought to the attention of the Engineer.
- All levels are in meters, related to Ordnance Datum Malin (ODM).
- All Northings and Eastings relate to the Irish Transverse Mercator (ITM) grid - the geographic coordinate system for Ireland as used by Ordnance Survey Ireland (OSi)

Appendix 3: Traffic and Transportation Assessment

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

BALLINREA 110KV SUBSTATION AND GRID CONNECTION

BALLINREA, CARRIGALINE, COUNTY CORK

Traffic and Transport Assessment

Final Version C - 27/07/23

Alan Lipscombe Traffic & Transport Consultants Ltd
Claran, Headford, Co Galway

Email -Info@alipscombetraffic.ie
Tel – 093 34777
Mob – 087 9308134

Client: Ballinrea Solar Farm Ltd
July 27th, 2023
Project No: 10651

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1 INTRODUCTION

1.1 Purpose of report

The purpose of this report is to assess the likely effects that will be incurred by local traffic during the construction and operation of the Proposed Development, which comprises of the following;

- Construction of a 110 kV cable grid connection from the Ballinrea Solar Farm Substation to the existing 220 kV Raffeen Substation. The proposed cable grid connection is 6.6km in length and will be constructed primarily within the confines of the existing public road network. The proposed route of the cable grid connection is shown in Figure 1.
- Construction of a 110 kV substation within the confines of the Ballinrea Solar Farm site which will include a control building, switchgear building, transformer compound and busbar compound.

Details with regards the method of construction for the proposed cable grid route and substation are provided in the Outline Construction Methodology, prepared by the TLI Group (Report ref 05887-R04-01, June 2023).

1.2 Statement of Authority

This assessment has been prepared by Alan Lipscombe of Alan Lipscombe Traffic and Transport Consultants. Alan is a competent expert in traffic and transport assessments. In 2007 Alan set up a traffic and transportation consultancy providing advice for a range of clients in the private and public sectors. Prior to this Alan was a founding member of Colin Buchanan's Galway office having moved there as the Senior Transportation Engineer for the Galway Land Use and Transportation Study. Since then Alan has worked throughout Ireland on a range of projects including: major development schemes, the Galway City Outer Bypass, Limerick Planning Land-Use and Transportation Study, Limerick Southern Ring Road Phase II and various studies for the NUI Galway. Over the past 15 years Alan has been involved in over 20 Wind Farm Projects, including the preparation of Traffic and Transport sections of EIAR's, which have included the assessment of grid connection routes, and attendance at Oral Hearings.

Before moving to Galway in 1997, Alan was involved in a wide variety of traffic and transport studies for Colin Buchanan and Partners throughout the UK, Malta and Indonesia.

1.3 Method of Assessment

Where relevant the report adopts the guidance for such assessments set out by Transport Infrastructure Ireland (TII), in the document 'Guidelines for Traffic and Transport Assessments, May 2014'. The assessment of the traffic impacts that will be incurred during the construction of the Proposed Development, and once it is operational, was undertaken based on the following;

Receiving environment – A review of the delivery routes to and from the Proposed Development and of the proposed grid connection route between the Ballinrea Solar Farm and the existing 220kV Raffeen substation. This includes an assessment of traffic counts undertaken on the proposed grid connection cable route in May 2023 and the production of traffic forecasts along the route for the proposed construction year of 2026.

Construction and Operational Phase Traffic – An estimation of the additional traffic that will be generated during the construction and operational phases of the Proposed Development.

Assessment of the Likely and Significant Impacts and Associated Mitigation Measures During Construction and when Operational – The main effects to existing traffic due to the construction of the proposed development will take the form of;

- Impacts due to increased traffic generated on the local road network during construction of the Proposed Development,
- Outside the extents of the Ballinrea Solar Farm site and the grounds of the Raffeen substation, it is proposed that the operation of all construction machinery, all trench excavation, the setting of the cable itself, and all other associated works will take place within the curtilage of the public road network. On most sections of the proposed cable route this will require a temporary closure of the section of the route being constructed. An assessment of the increased journey times and distance incurred by general traffic resulting from local road diversions during the construction of the grid connection cable route is undertaken.

An assessment of the impacts once the Proposed Development is in situ is also addressed.

2 RECEIVING ENVIRONMENT

2.1 Road network assessed for the Proposed Development

Delivery route to the Proposed Development

The proposed grid connection cabling route that will connect the Ballinrea Solar Farm development to the existing Raffeen 220 kV Substation is shown in Figure 1. All materials required for the construction of the Proposed Development will be delivered to the site via a combination of the following routes shown in Figure 2;

- For the cable and other specialist materials, and plant required for the construction of the Proposed Development, deliveries will be made via the N28, followed by the L-2490 and the Raffeen Local Road to the Raffeen Substation for the eastern section of the cable grid connection, and via the N28, followed by a short section of the R611, the L-2478 and L-2464 to the Ballinrea Solar Farm site for the western section of the route and the proposed 110 kV substation at Ballinrea.
- All stone and cement will be delivered from local quarries via the N28 and the same routes as set out above to the eastern and western sections respectively.
- It is proposed that excavated material shall be used to backfill the trench where appropriate with any surplus material transported off site and disposed of at a fully authorized soil recovery site, as specified in the Construction Environmental Management Plan prepared by MKO included as part of the planning application.

The proposed Grid Connection Cable Route

The proposed grid connection cabling route that will connect the Ballinrea Solar Farm development to the existing Raffeen 220 kV Substation is shown in Figure 1. For the purpose of the assessment presented in this report the route is split into 10 sections (or Links), as shown in Figure 3 and summarised in Table 1. It should be noted that the sections or links were based on changes in road type or road name and differ from the route sections discussed in the Outline Construction Methodology, prepared by the TLI Group (Report ref 05887-R04-01, June 2023).

Commencing at the Ballinrea Solar Farm site the proposed grid cable route is as follows;

Section 1 – (0.73 km) – The section of the route travels through the Ballinrea Solar Farm site from the proposed 110kV Substation and connects into the L-2426.

Section 2 – (1.16km) – The route then travels southeast for 1.16kms along the L-2464 to the junction with the L-2473. There is 1 culvert crossing on this section of the L-2464.

Section 3 – (0.84km) - From this point the routes travels east on the L-2473 for 0.84 kms. There is 1 culvert crossing on this section of the L-2473.

Section 4a – (0.49km) – The route then heads off road to cross through private lands CPO'd by Cork County Council for the M28 road scheme. There are 2 stream crossings on this section of the route.

Section 4b – (0.19km) – The route then travels in a southeastern direction along the N28 to connect into the N28 roundabout.

Section 5 – (0.49km) – The route then travels east for 0.49 kms to the junction with the L-2490 Fern Hill Road.

Sections 6, 7 and 8 – (0.28km, 0.18km and 1.05km) – From here the route turns right to head south on the L-2490 Fern Hill Road for 0.28 kms, before heading off road to the east of the L-2490 at the Ballyhemiken Bridge for 0.18km in order to cross a disused rail crossing using the horizontal direction drilling method. The route then re-joins the L-2490 continuing south for a further 1.05 kms towards Carrigaline East.

Section 9 – (0.72km) - The route then turns sharp left onto the Raffeen local road continuing for 0.72kms to the existing entrance to the Raffeen 220 kV substation site.

Section 10 – (0.49km) – At this point the route then travels a further 0.30kms along a private road through the site of the existing Raffeen substation followed by 0.19km through private land to the proposed cable bay at the northeast corner of the existing substation.

Table 1 Summary of grid route by section

Link number on public road	Roads impacted	Length (kms)	Average road width (w)	Number of water crossings	Typical traffic management measure
1	Local access Ballinrea	0.73	>6	0	Road closure
2	L-2464	1.16	5.5m to 6.0m	1 (1 x culvert crossing)	Road closure
3	L-2473	0.84	5.5m to 6.0m	1 (1 x culvert crossing)	Road closure
4a	Off road	0.49	NA	0	Road closure
4b	N28 (n)	0.19	>8.0m	2 (2 x stream crossings)	Retain 2-waye
5	N28 (e)	0.49	14.0m	0	Retain 2-way flow
6	L-2490	0.28	4.5m to 5.0	0	Road closure
7	Off Road	0.18	NA	1 (1 x HDD)	Road closure
8	L-2490	1.05	4.5m to 5.0m	0	Road closure
9	Raffeen local road	0.72	3.5m to 4.0m	0	Road closure
10	Local access Raffeen	0.49	>6	0	Road closure
Total		6.62			

2.2 Existing year 2023 background traffic flows

Classified turning counts were undertaken by Traffinomics Ltd on the various sections of the proposed grid cabling route as shown in Figure 3. The counts were undertaken on Wednesday 3rd May 2023 for the AM (07:00 to 10:00) and PM (16:00 to 19:00) peak periods, with the observed 2 - way volumes shown in Table 2

Continuous traffic counters are maintained by TII on the N28 at 2 locations passing through Carrigaline, with the data from these sites used to determine the factor to convert the 6 hour peak hour counts to 24 hours, which was derived to be as follows;

24 hour flows = 2.34 * ((AM peak period 07:00 to 10:00) + (PM peak hour 16:00 to 19:00))

The TII data was also used to provide the traffic count data for link Nos 4b and 5 which are on the N28. The 24 hour traffic flows derived for the various links on the cable grid route are shown in terms of 2-way traffic flows in Table 2.

Based on the above, current all day flows on the proposed grid cable route for the year 2023 are estimated to range from 1,048 vehicles per day on the Raffeen Local Road approaching the Raffeen 220kV substation site (Link 9), to 6,671 vehicles per day on the L-2464 adjacent to the Ballinrea Solar Farm site (Link 1), to 9,745 vehicles per day on the N28 eastern arm (Link 5) up to 23,266 vehicles on the N28 to the north of the roundabout (Link 4b).

A full listing of the traffic count data collated by Traffinomics is included as Appendix A, while the TTI ATC data used for the N28 is included as Appendix B.

Table 2 Observed traffic flow in peak hours, all day factor, average all day weekday flows, year 2023, May (2-way vehicles)

Link number	Description	Observed flow in peak hours (07:00 – 10:00 and 16:00 to 19:00)	All day factor	All day flow (Observed flow multiplied by All day factor) 2023
1	Local access Ballinrea	NA	NA	NA
2	L-2464	2,851	2.34	6,671
3	L-2473	1,877	2.34	4,392
4a	Off road	NA	NA	NA
4b	N28 (n)	NA	NA	23,266
5	N28 (e)	NA	NA	9,745
6	L-2490	1,908	2.34	4,465
7	Off Road	NA	NA	NA
8	L-2490	1,908	2.34	4,465
9	Raffeen local road	448	2.34	1,048
10	Local access Raffeen	NA	NA	NA

2.3 Construction year 2026 background traffic flows

For the purpose of this assessment, it is assumed that the construction of the grid cable route and substation will be undertaken in the year 2026.

Revised guidelines for forecasting annual growth in traffic volumes were produced by TII in October 2021[1]. The annual growth rates for light vehicles for County Cork and factors for the years relevant to this study are shown in Tables 3 and 4, with traffic volumes forecast to increase during the period from 2023 (the observed traffic count year) to 2026 (the assumed construction year) by 5.8% (shown as 1.058 in Table 4), assuming a medium growth scenario. Year 2023 and 2026 all day traffic flows on the study area network are compared in Table 5.

Again, using the observed traffic count data collated by Traffinomics on the various sections of the grid cable route, and the continuous traffic data retrieved from the N28 TII count site, the % of HGVs were determined for each link. The % of HGVs together with traffic flows by vehicle type are shown in Table 6. Traffic flows are also shown in terms of passenger car equivalent units, or pcus, where an HGV is given a weighting of 2.4 cars, as per TII guidelines. In terms of pcus, all day background traffic flows on the proposed grid cable route for the year 2026 are estimated to range from 1,126 pcus per day on the Raffeen Local Road approaching the Raffeen 220kV substation site (Link 9), to 7,167 pcus per day on the L-2464 adjacent to the Ballinrea Solar Farms site (Link 1), to 11,587 pcus per day on the N28 (Link 5) to a maximum of 26,304 pcus on the N28 to the north of the roundabout (Link 4b).

It is noted that while the assumed construction year of 2026 may vary slightly, it is considered that this will not alter the forecast outcomes and effects presented in this section of the EIAR.

Table 3 TII Traffic growth indices, cars and lgvs (County Cork)

Year	Lights - Annual factor			Lights - Cumulative index		
	Low	Medium	High	Low	Medium	High
2023	1.0173	1.0189	1.0223	1.000	1.000	1.000
2024	1.0173	1.0189	1.0223	1.017	1.019	1.022
2025	1.0173	1.0189	1.0223	1.035	1.038	1.045
2026	1.0173	1.0189	1.0223	1.053	1.058	1.068

Table 4 TII derived growth rates

Period	Factor		
	low	Medium	High
2023- 2026	1.053	1.058	1.068

[1] PE-PAG-02017 Project Appraisal Guidelines for National Roads Unit 5.3- Travel Demand Projections, TII, October 2021

Table 5 Observed year 2023 traffic flows and forecast construction year 2026 flows, vehicles

Link number	Description	All day flow 2023	All day flow 2026
1	Local access Ballinrea	NA	NA
2	L-2464	6,671	7,058
3	L-2473	4,392	4,647
4a	Off road	NA	NA
4b	N28 (n)	23,266	24,615
5	N28 (e)	9,745	10,310
6	L-2490	4,465	4,724
7	Off Road	NA	NA
8	L-2490	4,465	4,724
9	Raffeen local road	1,048	1,109
10	Local access Raffeen	NA	NA

Table 6 All day background traffic flows, percentage HGVs and flows by vehicle type, year 2026

Link	Description	All day flow (vehs)	% HGV's	Vehicle type			
				HGVs	Cars / lgvs	All vehs	Pcus
1	Local access Ballinrea	NA	NA	NA	NA	NA	NA
2	L-2464	7,058	1.10%	78	6,980	7,058	7,167
3	L-2473	4,647	3.52%	164	4,483	4,647	4,876
4a	Off road	NA	NA	NA	NA	NA	NA
4b	N28 (n)	24,615	4.90%	1,206	23,409	24,615	26,304
5	N28 (e)	10,310	8.50%	876	9,434	10,310	11,537
6	L-2490	4,724	0.40%	19	4,705	4,724	4,750
7	Off Road	NA	NA	NA	NA	NA	NA
8	L-2490	4,724	0.40%	19	4,705	4,724	4,750
9	Raffeen local road	1,109	1.12%	12	1,096	1,109	1,126
10	Local access Raffeen	NA	NA	NA	NA	NA	NA

3 PROPOSED DEVELOPMENT GENERATED TRAFFIC

3.1 Construction traffic

Grid cable route

A detailed description of the construction methodology for the proposed grid connection route is provided in in the Outline Construction Methodology, prepared by the TLI Group (Report ref 05887-R04-01, June 2023). With respect to determining the traffic impacts during the construction of the Proposed Development, the following points are noted;

- Additional traffic will be generated during the construction of the Proposed Development, by both staff travelling to / from the location of the construction, and by materials being transported to / from the point of construction along the cable grid route.
- Construction of the grid connection route will require a rolling construction site with work being undertaken at single location along the route. This could be increased to 2 locations in practice to reduce the construction duration.
- It is estimated that 100m of the proposed grid cable route will be constructed per day. For a grid cable route 6.6kms in length it is therefore estimated that general construction of the cable route will take 66 days.
- Additional time will be required to cross water courses of which there are 5 along the route (2 culvert crossings, 2 stream crossings and 1 location where horizontal direct drilling will be required to cross an existing bridge). It is estimated an additional 3 days will be required at each of these locations, resulting in an additional 15 days.
- Along the route there will be 9 bays constructed where the cables will require to be joined. At each of these joint bays 1 day will be required to pull cables through ducts, while an additional 5 days will be required to join the cables at each bay. This element of construction will require an additional 54 days.
- In total it is therefore estimated the construction phase for the grid cable route will take 135 working days or, at 5.5 days per week, 25 weeks, or 6 months.

It is forecast that up to 10 staff members will be employed at the grid cable work location. Due to the constricted work area it is proposed that staff will travel to the area of activity each day by shared car/van, generating 3 x 2-way car/van trips at the start and end of the day at each works location.

Other traffic movements to/ from the site will be as follows;

- Delivery of one excavator, one truck, HDD rig and other plant, as required, to the site. Some of these will not be new trips each day as they may be left on site overnight at the point of construction to commence work the following day.
- Materials will be delivered to the location of construction on the grid connection cable route each day using the delivery routes as shown in Figure 2. While excavated material will be used to backfill the cable trench any surplus material will be transported off site and disposed of at a fully authorised soil recovery site.
- Materials will be delivered to the off road sections to provide access tracks. A small number of truck movements will also be required to deliver cable route components (ducting, membranes, etc) to site. These will be infrequent and will be evenly spread out along the route.
- In total it is estimated that the plant and materials delivered to and from the site will result in an average of 15 additional truck movements to and from the construction site per day.
- A small number of vehicle movements will be required to deliver electrical components to the existing substation at Raffeen to facilitate the connection.

The total daily trip generation forecast for 135 days of the construction period for the Proposed Development is set out in Table 7. Based on the above, it is estimated that a total of 18 vehicle trips (15 HGVs and 3 cars/lgvs or 39 pcus), or 36 vehicle movements (30 HGVs and 6 cars/lgvs or 78 pcus), will be generated to and from the area of activity on each of the 135 days that construction of the proposed grid connection takes place.

Table 7 Trip generation during construction of the cable grid route by vehicle type, average construction day

Type	HGV	Car / lgv	All vehicles	Pcus
Trips	15	3	18	39
Movements	30	6	36	78

110 kV Ballinrea Substation

It is estimated that 150 loads of materials will require to be delivered to the Ballinrea Solar Farm site during the construction of the 110 kV substation, including delivery of the 33/110kV transformers which will be abnormally sized loads. It is noted that the swept path requirements of the abnormal loads were assessed as part of the planning application for the Ballinrea Solar Farm.

While it is estimated that the construction of the proposed substation will take 14 months it is likely that deliveries will be concentrated on 10 days, with similar volumes of traffic forecast for the cable

grid connection route (ie 15 x 2-way HGV trips) generated on the busiest days substation construction days.

3.2 Operational traffic

Once the construction of the proposed grid cable route and substation is complete there will be 1 to 2 traffic movements generated per month by maintenance staff.

4 LIKELY AND SIGNIFICANT IMPACTS AND ASSOCIATED MITIGATION MEASURES

4.1 Do-Nothing Scenario

With respect to traffic effects, if the proposed grid cable connection between the Raffeen 220 kV substation and the proposed Ballinrea Solar Farm is not constructed, there would be no traffic related impacts on the roads discussed in this assessment.

4.2 Construction Phase Impacts

Pre-Mitigation Impacts

Impact to traffic is considered under the following headings;

- Impacts due to increased traffic generated on the local road network during construction of the Proposed Development,
- Increased journey time - due to time spent undertaking local diversions on sections of the route with temporary road closures, and,
- Increased travel distance - as a result of local diversions.

The assessment was undertaken based on the grid connection route split into the sections shown in Figure 3.

Impacts of additional generated traffic for the grid connection cable route

Background traffic levels are shown together with construction generated traffic, and the percentage increase as a result of the proposed development, by links and vehicle type in Table 8. On the days that construction of the proposed grid connection will take place, the actual volume of additional traffic movements will be relatively small (30 additional HGV movements, 6 car movements ad 78 pcus). As a result, in terms of pcus, the largest % increase is forecast to be on the Raffeen Local Road (link 10), where a 7% increase in traffic volumes is forecast, with all other links forecast to experience a 1% to 2% increase in traffic volumes. It is noted that as the existing volumes of HGVs on some links is very low, the additional 30 HGV movements generated by the proposed development is forecast to have a noticeable impact in percentage terms. For example, on the Raffeen Local Road (link 10), where there are just 12 HGV movements per day at present, the additional 30 movements will result in an 242% increase.

Table 8 Background traffic flows, development generated traffic flows, total traffic and percentage increase during construction, year 2026

Link	Background traffic			Development generated traffic			Total traffic (Background + Development)			Percentage increase due to development		
	HGV	Car / lgv	pcus	HGV	Car / lgv	pcus	HGV	Car / lgv	pcus	HGV	Car / lgv	pcus
1	NA	NA	NA	30	6	78	NA	NA	NA	NA	NA	NA
2	78	6,980	7,167	30	6	78	108	6,986	7,245	39%	0%	1%
3	164	4,483	4,876	30	6	78	194	4,489	4,954	18%	0%	2%
4a	NA	NA	NA	30	6	78	NA	NA	NA	NA	NA	NA
4b	1,206	23,409	26,304	30	6	78	1,236	23,415	26,382	2%	0%	0%
5	876	9,434	11,537	30	6	78	906	9,440	11,615	3%	0%	1%
6	19	4,705	4,750	30	6	78	49	4,711	4,828	159 %	0%	2%
7	NA	NA	NA	30	6	78	NA	NA	NA	NA	NA	NA
8	19	4,705	4,750	30	6	78	49	4,711	4,828	159 %	0%	2%
9	12	1,096	1,126	30	6	78	42	1,102	1,204	242 %	1%	7%
10	NA	NA	NA	30	6	78	NA	NA	NA	NA	NA	NA

Impacts of additional generated traffic for the 110 kV Ballinrea Substation

It is estimated that the construction of the 110 kV substation will take 14 months during which approximately 150 loads of material will be delivered to and from the Ballinrea Solar Farm site. It is estimated that traffic volumes generated during the busiest substation construction days, and the associated traffic impacts, will be similar to those set out above for the grid cable construction days

Impacts on local traffic due to grid connection route construction

Based on observations and a sample of road widths measured on site, a preliminary estimate of the likely traffic management measures (TMM) required for each section was made. As set out in

Table 1 the road widths for all sections of the local road network along which the proposed grid connection runs are between 3.5m to 6.0m, with the exception of the sections of the N28 (Links 4b and 5) which have an overall carriageway width of approximately 8m (plus verge) and 14m respectively. Taking a precautionary approach, for the purpose of the assessment it is assumed that localised closures of each section of public road will occur where construction is taking place. The exception to this is the sections of the N28 where it is assumed that 2-way traffic flows will be retained by means of localised traffic management measures.

For all off road sections of the route, local access for deliveries and construction staff will be provided using temporary traffic management measures, including signage and a flagman (See Section 4.3 of this report). As no traffic diversions will be required on these sections it is assumed that general traffic will not be impacted. The off road sections of the grid cable route are the local access roads into the Ballinrea Solar Farm (Link 1), the section passing through Cork County Council and privately owned lands west of the N28 (Link 4a), the short off road section to the east of the L-2490 (Link 7), and the local access into the Raffeen Substation (Link 10).

An estimate of the additional distance and journey time that will be incurred by local traffic due to all works associated with ground excavation and the construction of the grid connection along the route is estimated for the detours set out by route section as specified in Figures 4a to d. The associated additional journey distances and times are set out in Table C1 of Appendix C. The detours shown in Figures 4a to 4d are based on the shortest feasible route using a similar road type.

It is estimated that the detours incurred by local traffic will range from zero kms and minutes for off road sections of the route, to a maximum of 1.95km and 2.34 minutes (based on an average speed of 50km/h), which it is estimated will be incurred by traffic that uses Section 9 of the grid route on the Local Raffeen Road.

An assessment of the overall impacts in local traffic during the construction of the proposed grid cable connection is based on the following;

- An estimate of the duration of the construction on each section (i.e. Section Nos 1- 10 shown in Figure 3) based on 100m of grid cable route being completed each day by one team commencing at one end of the cable route. In the event that work is undertaken by 2 teams consecutively starting at either end of the cable route, the length of route covered each day would increase to 200m.

- An estimate of the daily traffic flow on each section, as set out in Table 5.

- Estimates of the average additional distance travelled and journey time as a result of detours required due to temporary road closures, as discussed above and set out in Table C1 of Appendix C.

Similar assumptions were applied to the impact on local traffic during construction works associated with crossing of 5 no. watercourses along the route, as shown in Figure 5, and at the 9 proposed cable joint bays on the route as shown in Figure 6.

The forecast traffic impacts associated with the works on the local road network are set out in Table C2 of Appendix C, with the same information for the proposed water crossings set out in Table C3, for joint bays in Table C4 with the total impacts for all works summated in Table C5.

The main points to note from the Tables are as follows;

- It is estimated that traffic impacts on the local network will be experienced by local traffic on a total of 135 working days on which deliveries will be made to the point of construction.
- Of these 135 days, traffic will be required to divert from the point of construction onto an alternative route on 100 days. (ie no diversion required during construction of off-road sections or during construction on the N28).
- The maximum diversion that will be experienced will be on the 13 days when the grid connection is constructed on the Local Raffeen Road (Link 9) when a total of 1,109 trips per day will require to travel an additional 1.95 kms adding an additional 2.34 minutes to each journey.
- During the entire construction period of 135 working days, a total of 430,638 trips on the route will experience an impact, resulting in a total of 11,441 additional vehicle hours spent travelling on the network, and 572,065 vehicle kms travelled on the network during the construction period. For vehicles affected during the construction period this will result in an average of 1minutes and 36 seconds added to each journey time and an average detour of 1.33 kms.

Overall Pre-Mitigation Impacts

During the construction period of the proposed grid connection the effects on the road network will be negative in terms of increased traffic volumes due to additional construction traffic travelling on the network and as a result of detours that will be incurred by general traffic. The effects will be temporary and will range in terms of severity from imperceptible to slight.

While the construction generated traffic will be noticeable on the local highway network, the impact due to increased traffic volumes will be negative, temporary and slight.

4.3 Proposed mitigation measures

Measures to be included in a Traffic Management Plan (TMP) are set out below. In the event planning consent is granted for the Proposed Development, a detailed TMP incorporating all mitigation measures will be prepared prior to commencement to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval. The TMP will include the following:

Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.

Delivery Programme – a programme of deliveries will be submitted to Cork County Council in advance of deliveries of material to the cable route and substation sites. Liaison with the relevant local authorities and TII will be carried out where required regarding requirements such as delivery timetabling.

Information to locals – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane / road closures, via letter drops and posters in public places. Information will include the contact details of the Contract Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided. Local access to all properties located on the cable grid route will be maintained at all times.

A Pre and Post Construction Condition Survey – A pre-condition survey of roads associated with the proposed development will be carried out immediately prior to construction commencement to record an accurate condition of the road network at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Liaison with the relevant local authority – Liaison with Cork County Councils roads department will continue through the duration of the construction period. Once the surveys have been carried out and “prior to commencement” status of the relevant roads established, (and in compliance with the provisions of the CEMP), the Roads section will be informed of the name and contact number of the Project Supervisor of the construction stage as well as the Site Environmental Manager.

Identification of delivery routes – These routes will be agreed and adhered to by all contractors at all times.

Travel plan for construction workers – While the assessment above has assumed the worst case that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking, which will be at the construction compound.

Temporary traffic signs – As part of the traffic management measures temporary traffic signs will be put in place at the location where works are being undertaken along the cable grid route, at locations where temporary local diversions are in place. All measures will be in accordance with the *"Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works"* (DoT now DoTT&S) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at each construction site location along the route.

Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities at the entrance to the site and sweeping / cleaning of local roads as required.

Re-instatement works - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the Cork County Council Engineers. A roads conditions survey (and any other analyses required by the Roads Section) will be undertaken immediately prior to construction commencement of the project to assess the condition of the road network at that time and to agree any required works with the local authority. Such a survey will be repeated immediately after completion of the construction phase of the project in order to ensure that any reinstatement works were carried out to a satisfactory standard as required by Cork County Council.

Road Opening Licence – Roads works associated with the grid connection cabling will be undertaken in line with the requirements of a road opening licence as agreed with Cork County Council.

Diversions and road closures – Reasonable access to residences, farms and businesses will be maintained at all times during any road closures associated with the grid connection works. The details of this will be agreed with the roads authority in advance of works taking place. The network of local roads in the area will be used for traffic diversions for local traffic in order to expedite the works and limit the duration of the impact of the grid connection works.

Trench Reinstatement - Trenches on public roads, once backfilled, will be reinstated to the satisfaction of the roads authority. The roads conditions survey, which will be undertaken immediately prior to construction commencement of the project, will ensure that any section of road along the grid connection route is not left in a degraded condition. The repetition of the survey

immediately after completion of the construction phase of the project will ensure that any reinstatement works were carried out to a satisfactory standard.

4.4 Residual impacts

Slight increases in traffic delays and journey times will be incurred along the grid connection route resulting in a slight / medium, temporary impact on local traffic, and potentially on local businesses.

Significance of Effects

Based on the assessment above there will be no significant effects on the carrying capacity of the public road network or local traffic during the construction phase of the Proposed Development.

4.5 Operational phase impacts

There will be minimal effects on traffic during the operational phase of the proposed cable grid connection as all required works will be completed during the construction phase unless required for maintenance at substations or in the event of a fault occurring along the route. It is expected that this will be infrequent resulting in 1 to 2 trips by maintenance staff per month to the substation. During the very rare occasions when maintenance is required a short term road closure may be required at the location of the fault. During such times it is considered that the impacts on the local road network will be negative, temporary and will be imperceptible. On completion of the proposed underground cabling works, the road corridors in which the works are to be undertaken will be fully reinstated, leaving no visible above-ground evidence of the proposed works that have the potential to give rise to any operational phase effects. The reinstatement planed for the public road corridor will be agreed with Cork County Council prior to any works taking place.

4.6 Cumulative effects

The projects considered as part of the cumulative impact assessment include the proposed Ballinrea Solar Farm development.

Construction of the proposed cable route and 110 kV substation will likely take place at generally the same time as the construction of the proposed Ballinrea Solar Farm, in order to minimise the duration of disruption to residents and traffic in the area. In the event the construction phases for both developments are consecutive, there will be no cumulative traffic related impacts between the 2 developments. Alternatively, if the development of the proposed Ballinrea 110kV substation and grid connection is constructed in parallel to at the Ballinrea Solar Farm, it is recommended that the section the grid connection route on the L-2464 Ballinrea Road, which is on the delivery route for the Ballinrea Solar Farm, is constructed consecutively. Based on the relatively low volumes of traffic generated by both developments it is considered that the potential for cumulative impacts will be temporary, and slight in terms of severity.

5 SUMMARY AND CONCLUSIONS

5.1 Summary

An assessment was undertaken to establish the traffic impacts that would be incurred by existing traffic on the local road network during the construction and operation of the proposed grid connection route between the Ballinrea Solar Farm and the existing 220kV Raffeen substation, and the proposed substation at the site of the Ballinrea Solar Farm.

The assessment presented demonstrates that the traffic effects resulting from the construction of the proposed underground cable grid connection and substation will last approximately 6 months for the former and 14 months for the later. As little traffic will be generated on many of the days during the construction of the substation, it will be practical to undertake the construction of the 2 elements concurrently, shortening the overall duration to 14 months.

During the period when materials, plant and construction staff are transported to the site traffic volumes on the local network will increase in general by 1% to 2%, with the Raffeen Local Road forecast to experience a 7% increase during this period.

The construction of the grid cable route will require localised road closures at the point of construction at all locations on the route. The exception to this will be the short sections on the N28, which will accommodate 2-way traffic and the construction of the grid cable connection.

Diversion routes for each section of the route are identified, as are mitigation measures in order to minimise the impact of the construction of the proposed development.

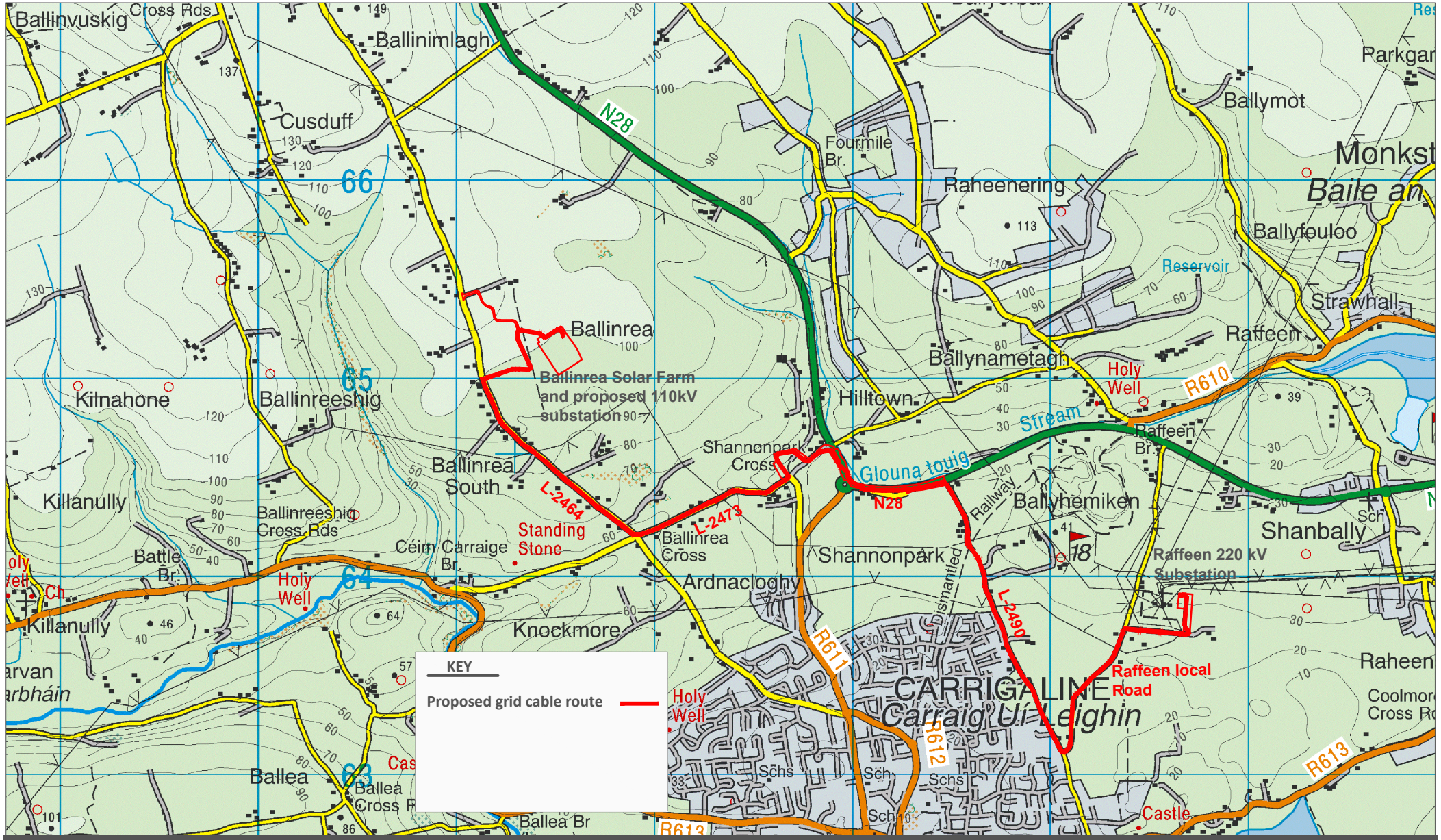
In terms of impacts to local traffic it is estimated that the maximum diversion that will be experienced will be on the 13 days when the grid connection is constructed on the Local Raffeen Road (Link 9) when a total of 1,109 trips per day will require to travel an additional 1.95 kms adding an additional 2.34 minutes to each journey. During the entire construction period of the cable grid route of 135 working days it is estimated that a total of 430,638 trips on the local road network will experience an impact, with an average of 1minute 36 seconds and 1.35kms added to each journey. During the construction of the Proposed Development, it is considered that the traffic related impacts will be temporary and slight.

Once the Proposed Development is complete it is considered that traffic related impacts will be imperceptible.

5.2 Conclusion

It is concluded from this assessment that the Proposed Development, including the traffic management and mitigation measures set out in this report, will be adequately accommodated by the existing and proposed receiving environment.

FIGURES



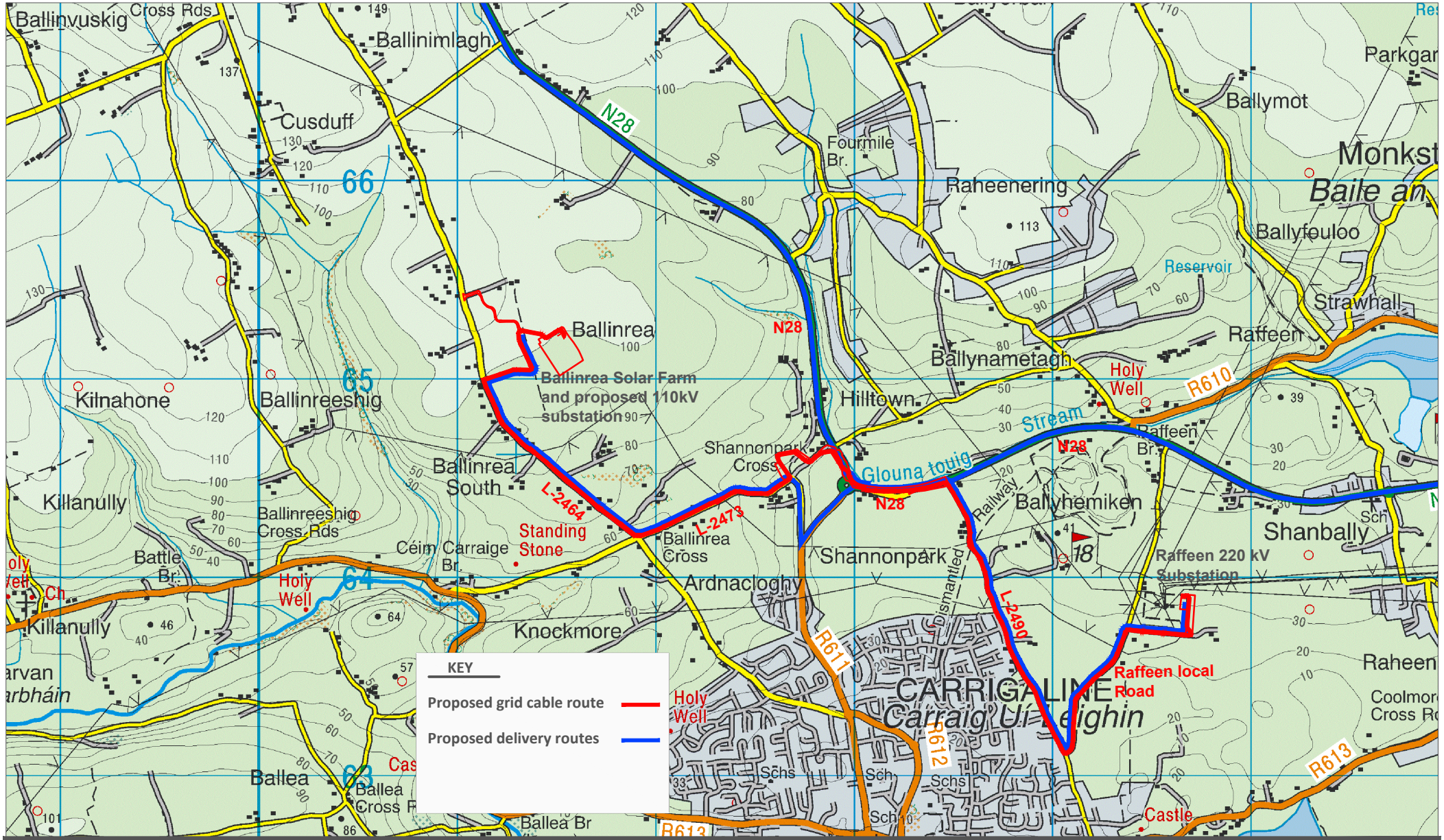
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 1 Proposed grid cable route

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 2 Delivery routes to proposed grid cable route

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



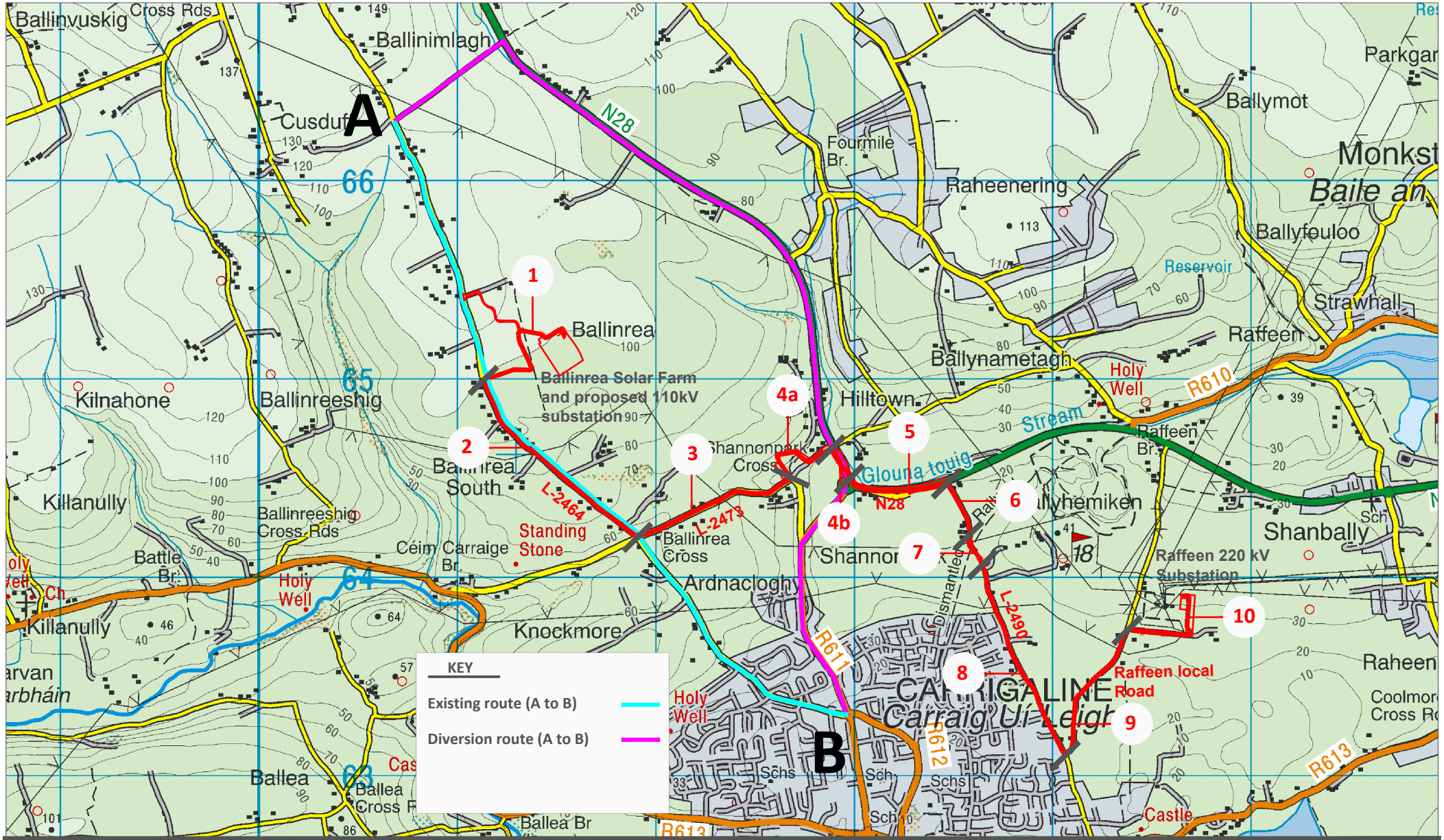
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 3 Proposed cable route - links for traffic assessment

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



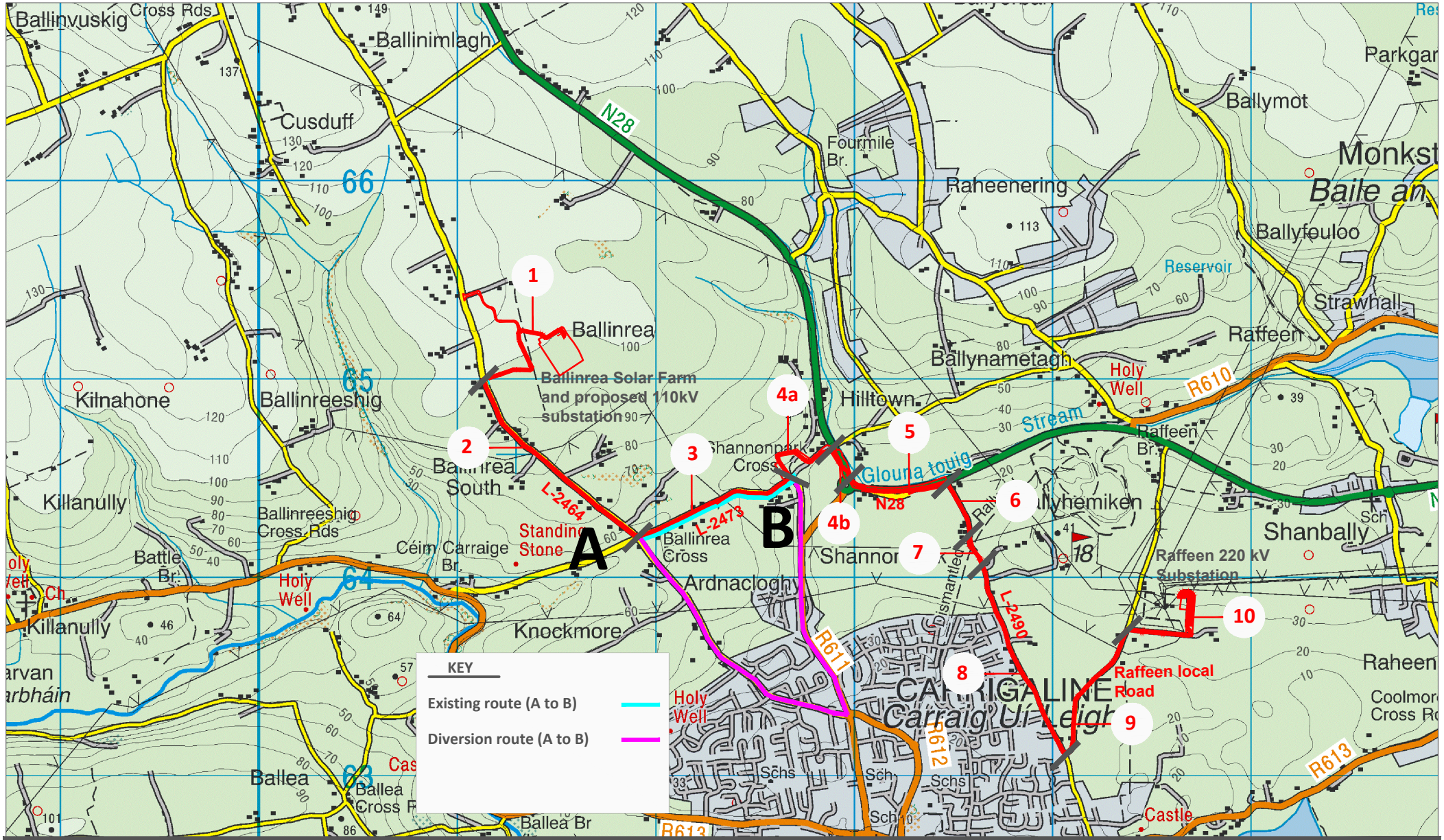
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 4a Proposed diversion routes during construction - Link 2

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



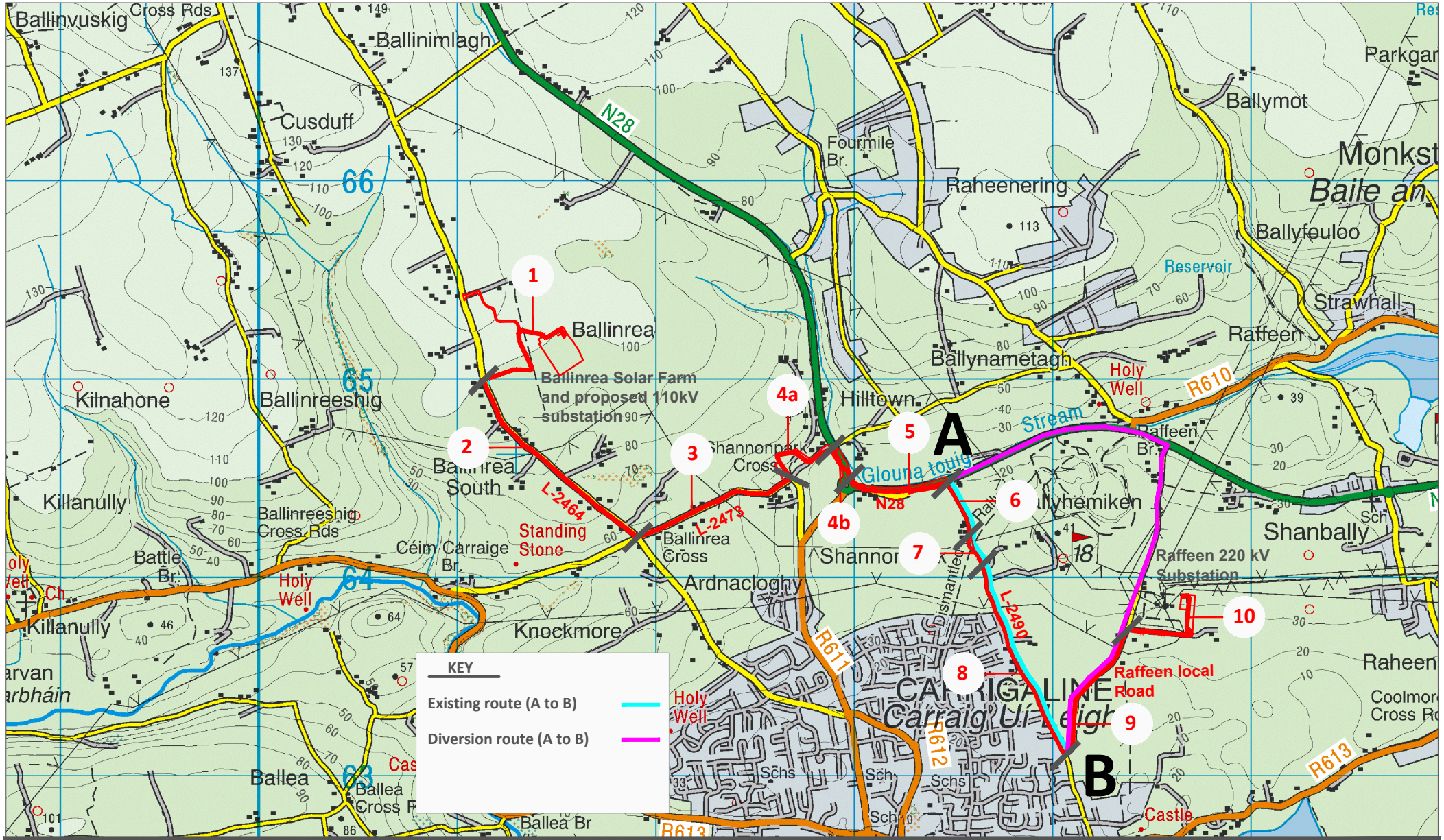
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PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 4b Proposed diversion routes during construction - Link 3

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



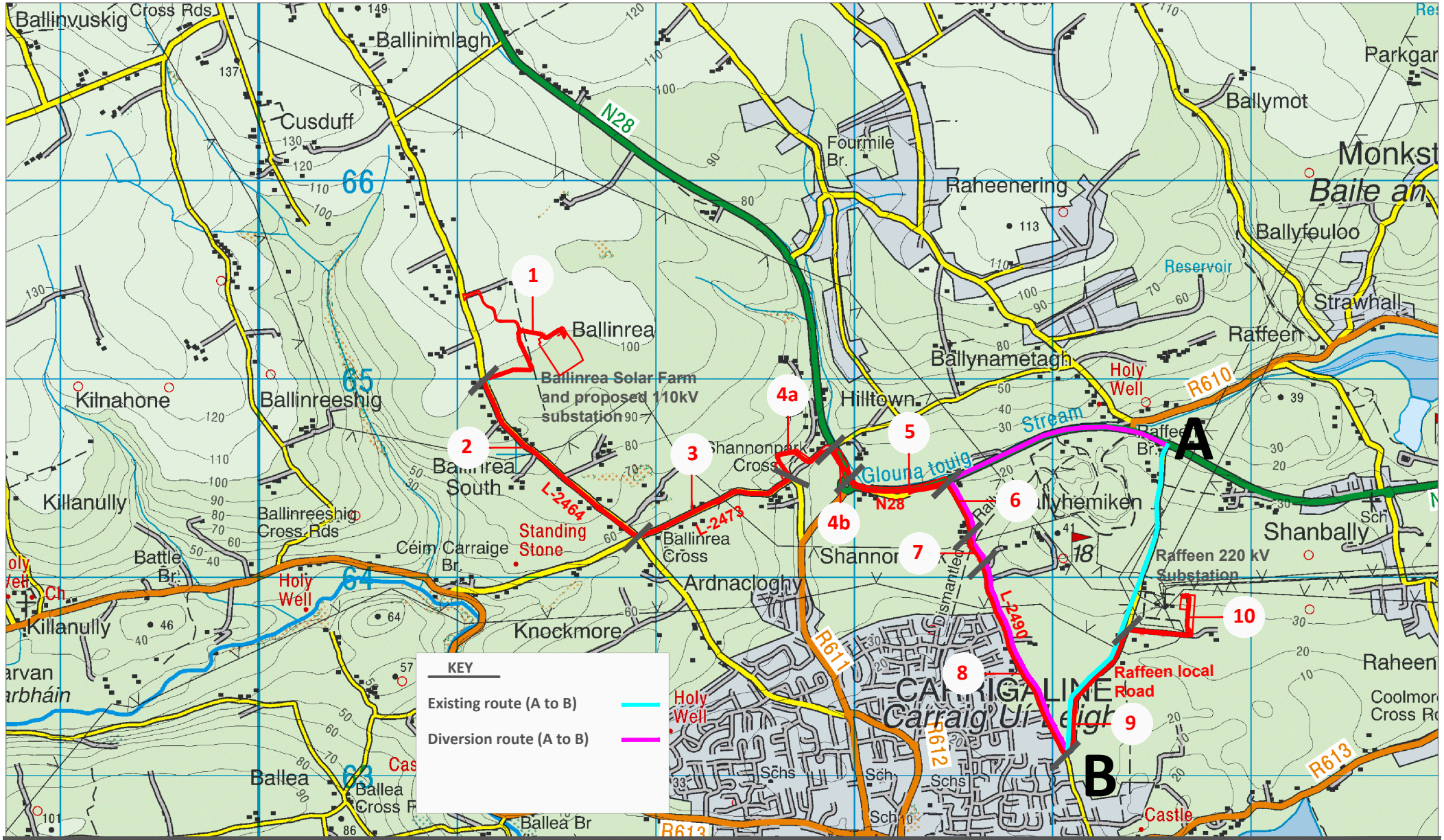
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PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 4c Proposed diversion routes during construction - Links 6 & 8

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



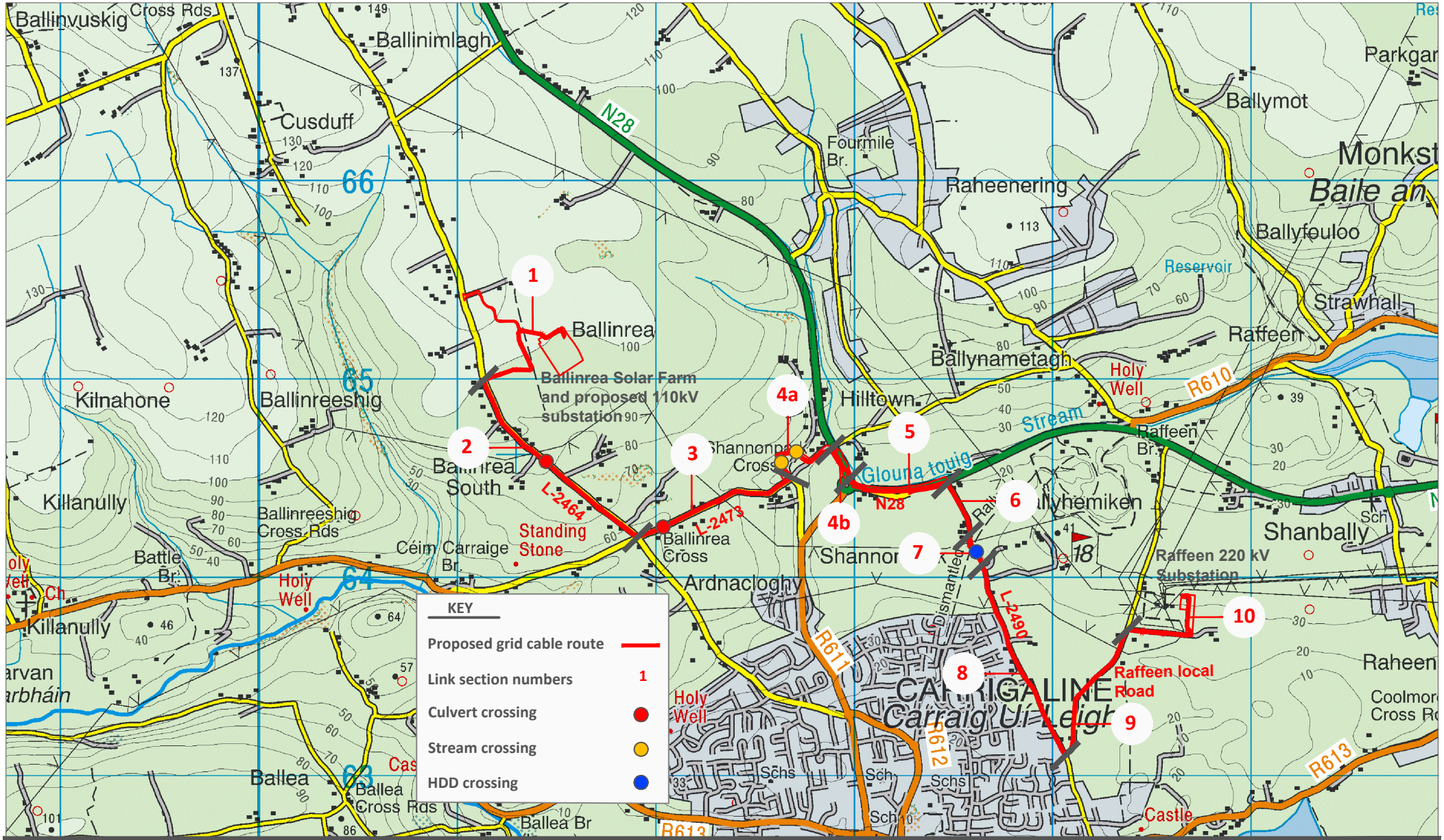
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 4d Proposed diversion routes during construction - Link 9

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



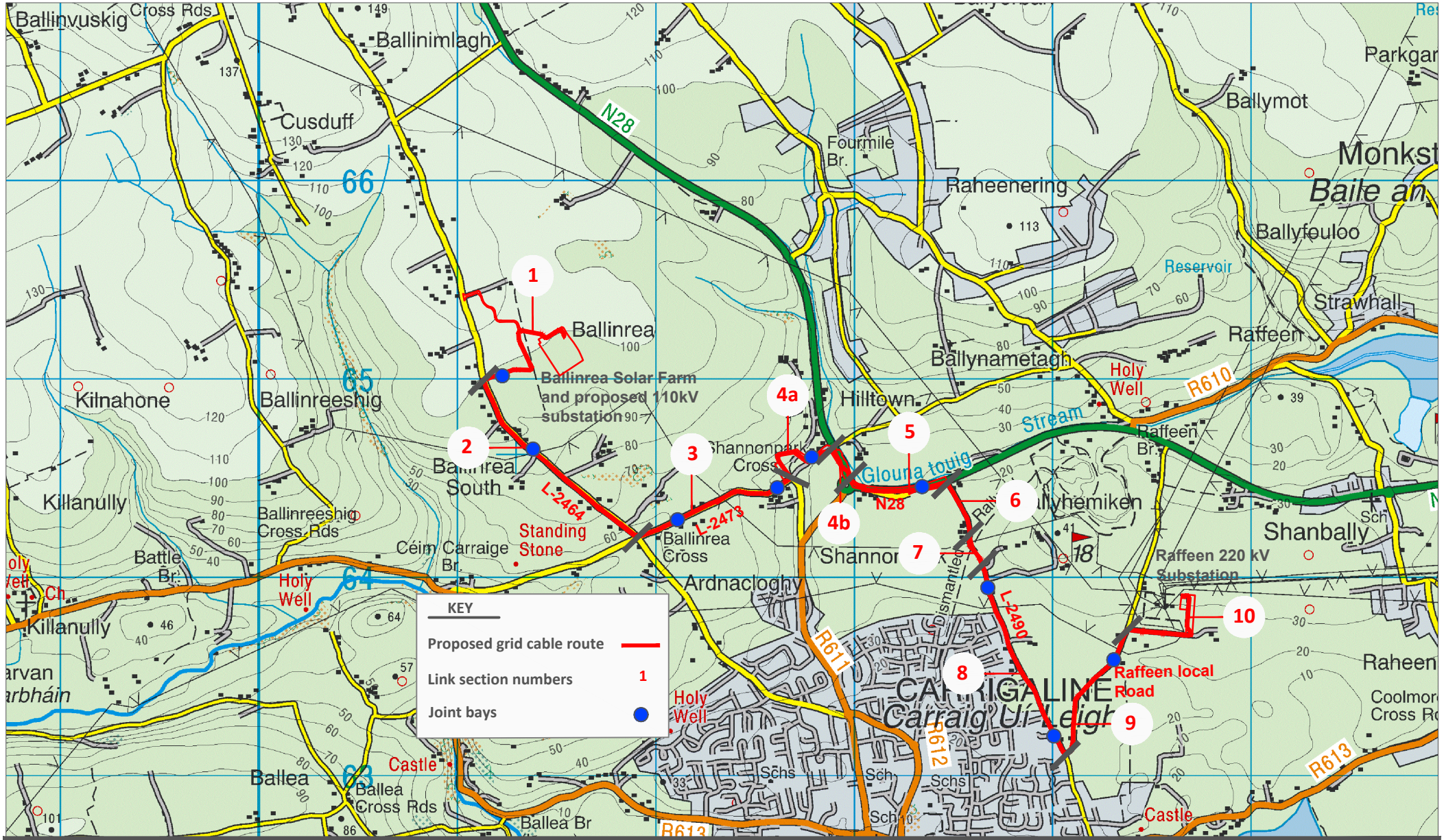
NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 5 Proposed cable route - location of water crossings

PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 6 Proposed cable route - location of joint bays

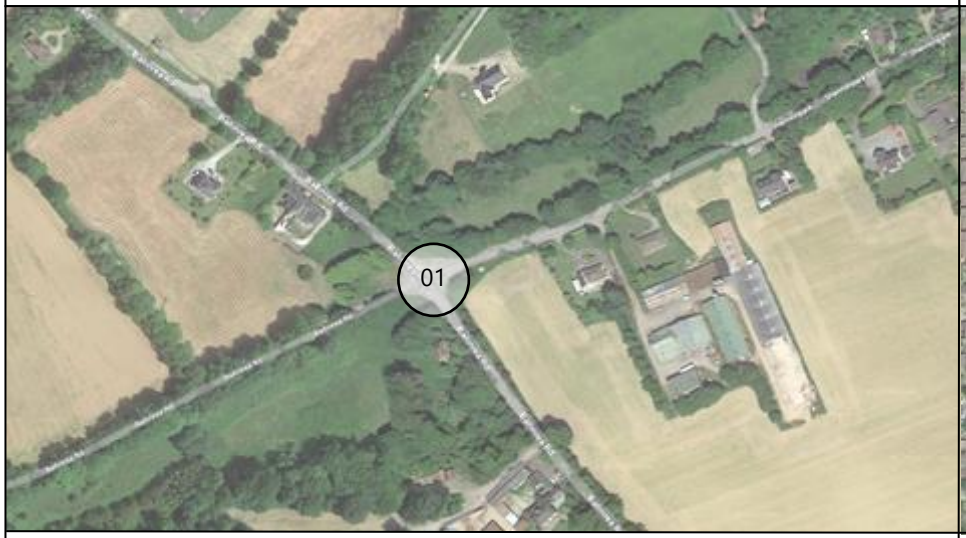
PROJECT:	Ballinrea 110kV Substation and Grid Connection		
CLIENT:	Ballinrea Solar Farm Ltd	SCALE:	NTS
PROJECT NO: 10651	DATE: 17.07.23	DRAWN BY:	AL

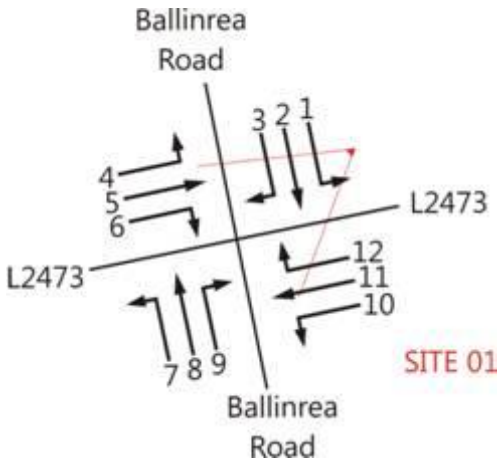
ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Appendix A

Observed Traffic Count Survey Data, L-2464 / L-2473 junction and L-2490 / Raffeen Local Road Wednesday 3rd May, 2023 (Traffinomics Ltd)

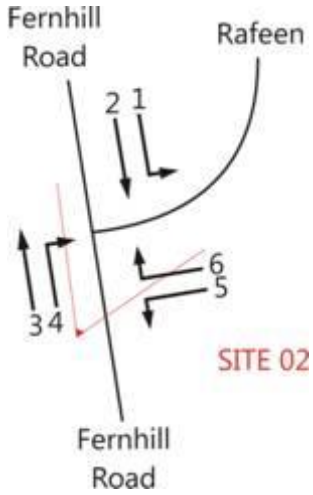
Site/Movement Numbers





Site/Movement Numbers





Job number: TRA/23/097	Job Date: 3rd May 2023	Drawing No: TRA/23/097-01	traffinomics.ie
Client: Alan Lipscombe Traffic	Job Day: Wednesday	Author: SPW	

TRAFFINOMICS LIMITED

CARRIGALINE TRAFFIC COUNTS **MAY 2023**

MANUAL CLASSIFIED JUNCTION TURNING COUNTS **TRA/23/097**

SITE: 01 DATE: 3rd May 2023

LOCATION: Ballinrea Road/L2473 DAY: Wednesday

	MOVEMENT 1							MOVEMENT 2							MOVEMENT 3						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
07:00	3	0	0	0	0	3	3	38	6	0	0	1	45	46	1	0	0	0	0	1	1
07:15	7	2	0	0	0	9	9	34	13	0	0	0	47	47	0	1	0	0	0	1	1
07:30	9	0	0	0	0	9	9	44	15	0	0	0	59	59	1	0	0	0	0	1	1
07:45	22	4	0	0	0	26	26	53	8	1	0	0	62	63	2	1	0	0	0	3	3
H/TOT	41	6	0	0	0	47	47	169	42	1	0	1	213	215	4	2	0	0	0	6	6
08:00	11	1	0	0	0	12	12	63	4	2	0	0	69	70	3	1	0	0	0	4	4
08:15	12	1	0	0	0	13	13	52	7	1	0	0	60	61	3	1	0	0	0	4	4
08:30	14	2	0	0	0	16	16	36	4	0	0	0	40	40	8	0	0	0	0	8	8
08:45	7	2	0	0	0	9	9	18	1	1	0	0	20	21	4	1	0	0	0	5	5
H/TOT	44	6	0	0	0	50	50	169	16	4	0	0	189	191	18	3	0	0	0	21	21
09:00	11	5	0	0	0	16	16	25	1	0	0	0	26	26	12	0	0	0	0	12	12
09:15	4	0	0	0	0	4	4	19	4	1	0	1	25	27	1	0	0	0	0	1	1
09:30	2	1	0	0	0	3	3	12	3	0	0	1	16	17	1	0	0	0	0	1	1
09:45	6	2	0	0	0	8	8	18	3	1	0	0	22	23	2	0	0	0	0	2	2
H/TOT	23	8	0	0	0	31	31	74	11	2	0	2	89	92	16	0	0	0	0	16	16
P/TOT	108	20	0	0	0	128	128	412	69	7	0	3	491	498	38	5	0	0	0	43	43

	MOVEMENT 1							MOVEMENT 2							MOVEMENT 3						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
16:00	3	2	0	0	0	5	5	31	1	1	0	0	33	34	2	0	0	0	0	2	2
16:15	2	0	0	0	0	2	2	19	5	0	0	0	24	24	3	2	0	0	0	5	5
16:30	6	1	0	0	0	7	7	33	1	0	0	0	34	34	5	0	0	0	0	5	5
16:45	6	0	0	0	0	6	6	43	2	0	0	0	45	45	5	2	0	0	0	7	7
H/TOT	17	3	0	0	0	20	20	126	9	1	0	0	136	137	15	4	0	0	0	19	19
17:00	8	0	0	0	0	8	8	38	4	0	0	0	42	42	9	2	0	0	0	11	11
17:15	6	1	0	0	0	7	7	41	7	1	0	0	49	50	3	0	1	0	0	4	5
17:30	7	0	0	0	0	7	7	30	1	1	0	0	32	33	5	0	0	0	0	5	5
17:45	11	1	0	0	0	12	12	34	3	0	0	0	37	37	9	0	0	0	0	9	9
H/TOT	32	2	0	0	0	34	34	143	15	2	0	0	160	161	26	2	1	0	0	29	30
18:00	10	2	0	0	0	12	12	42	4	0	0	0	46	46	5	2	0	0	0	7	7
18:15	13	1	0	0	0	14	14	35	1	0	0	0	36	36	5	0	0	0	0	5	5
18:30	3	1	0	0	0	4	4	33	5	1	0	0	39	40	8	1	0	0	0	9	9
18:45	4	0	0	0	0	4	4	34	3	0	0	0	37	37	9	2	0	0	0	11	11
H/TOT	30	4	0	0	0	34	34	144	13	1	0	0	158	159	27	5	0	0	0	32	32
P/TOT	79	9	0	0	0	88	88	413	37	4	0	0	454	456	68	11	1	0	0	80	81

TRAFFINOMICS LIMITED

CARRIGALINE TRAFFIC COUNTS **MAY 2023**

MANUAL CLASSIFIED JUNCTION TURNING COUNTS **TRA/23/097**

SITE: 01 DATE: 3rd May 2023

LOCATION: Ballinrea Road/L2473 DAY: Wednesday

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**
07:00	2	0	0	1	0	3	4	12	2	1	0	0	15	16	5	1	0	0	0	6	6
07:15	5	0	0	0	0	5	5	9	3	1	3	0	16	20	2	1	0	0	0	3	3
07:30	16	2	0	1	0	19	20	11	0	1	0	0	12	13	4	0	0	0	0	4	4
07:45	13	1	0	0	0	14	14	18	1	1	0	0	20	21	11	2	0	0	0	13	13
H/TOT	36	3	0	2	0	41	44	50	6	4	3	0	63	69	22	4	0	0	0	26	26
08:00	18	3	0	1	0	22	23	33	3	2	2	0	40	44	15	1	0	0	1	17	18
08:15	8	0	0	0	0	8	8	35	1	0	2	0	38	41	44	0	0	0	0	44	44
08:30	14	0	0	0	0	14	14	28	3	0	0	0	31	31	64	1	0	0	0	65	65
08:45	19	0	0	0	0	19	19	28	3	1	4	0	36	42	30	1	0	0	0	31	31
H/TOT	59	3	0	1	0	63	64	124	10	3	8	0	145	157	153	3	0	0	1	157	158
09:00	17	2	0	0	0	19	19	16	2	0	1	0	19	20	5	1	0	0	0	6	6
09:15	9	0	1	0	0	10	11	18	3	0	2	0	23	26	18	1	0	0	1	20	21
09:30	5	1	2	0	0	8	9	12	5	0	3	0	20	24	4	1	0	0	0	5	5
09:45	5	0	0	2	0	7	10	6	0	0	2	0	8	11	5	3	0	0	0	8	8
H/TOT	36	3	3	2	0	44	48	52	10	0	8	0	70	80	32	6	0	0	1	39	40
P/TOT	131	9	3	5	0	148	156	226	26	7	19	0	278	306	207	13	0	0	2	222	224

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**
16:00	4	2	0	0	0	6	6	6	4	1	2	0	13	16	9	3	0	1	1	14	16
16:15	10	4	0	0	0	14	14	12	5	0	2	0	19	22	14	1	1	0	0	16	17
16:30	12	0	1	0	0	13	14	14	2	0	1	0	17	18	10	2	0	0	0	12	12
16:45	13	2	0	0	0	15	15	15	5	0	0	0	20	20	19	2	0	0	0	21	21
H/TOT	39	8	1	0	0	48	49	47	16	1	5	0	69	76	52	8	1	1	1	63	66
17:00	6	0	0	0	0	6	6	19	2	0	0	0	21	21	26	0	1	0	1	28	30
17:15	9	0	0	0	0	9	9	29	4	0	0	0	33	33	35	5	0	0	0	40	40
17:30	7	1	0	0	0	8	8	29	5	0	1	0	35	36	18	3	0	0	0	21	21
17:45	11	1	0	0	0	12	12	43	3	0	0	0	46	46	28	5	0	0	0	33	33
H/TOT	33	2	0	0	0	35	35	120	14	0	1	0	135	136	107	13	1	0	1	122	124
18:00	2	1	0	0	0	3	3	31	2	0	0	0	33	33	26	4	0	0	0	30	30
18:15	9	1	0	0	0	10	10	21	2	0	0	0	23	23	11	1	0	0	0	12	12
18:30	7	0	0	0	0	7	7	16	0	0	0	0	16	16	12	0	0	0	1	13	14
18:45	3	1	0	0	0	4	4	9	1	0	0	0	10	10	12	1	0	0	0	13	13
H/TOT	21	3	0	0	0	24	24	77	5	0	0	0	82	82	61	6	0	0	1	68	69
P/TOT	93	13	1	0	0	107	108	244	35	1	6	0	286	294	220	27	2	1	3	253	258

TRAFFINOMICS LIMITED

CARRIGALINE TRAFFIC COUNTS **MAY**
MANUAL CLASSIFIED JUNCTION TURNING COUNTS **TRA/23**

SITE: 01 DATE: 3rd May

LOCATION: Ballinrea Road/L2473 DAY: Wedne

	MOVEMENT 7							MOVEMENT 8							MOVEMENT 9					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT
07:00	2	1	0	0	0	3	3	29	2	0	0	0	31	31	0	0	0	0	0	0
07:15	9	1	0	0	0	10	10	35	7	0	0	0	42	42	0	0	0	0	0	0
07:30	16	2	0	0	0	18	18	67	4	0	0	0	71	71	0	0	0	0	0	0
07:45	14	5	0	0	1	20	21	71	4	0	0	0	75	75	0	0	0	0	0	0
H/TOT	41	9	0	0	1	51	52	202	17	0	0	0	219	219	0	0	0	0	0	0
08:00	20	4	0	0	0	24	24	54	7	0	0	0	61	61	3	1	0	0	0	4
08:15	31	0	0	1	0	32	33	58	4	0	0	0	62	62	4	0	0	0	0	4
08:30	29	3	0	0	0	32	32	44	5	0	0	0	49	49	8	1	0	0	0	9
08:45	53	0	1	0	1	55	57	43	1	0	0	0	44	44	14	1	0	0	0	15
H/TOT	133	7	1	1	1	143	146	199	17	0	0	0	216	216	29	3	0	0	0	32
09:00	20	2	0	0	0	22	22	40	3	1	0	0	44	45	1	0	0	0	0	1
09:15	9	0	0	0	0	9	9	38	5	2	0	0	45	46	1	0	0	0	0	1
09:30	7	1	0	0	0	8	8	28	0	1	0	1	30	32	1	0	0	0	0	1
09:45	8	1	0	0	0	9	9	22	5	0	0	0	27	27	0	0	0	0	0	0
H/TOT	44	4	0	0	0	48	48	128	13	4	0	1	146	149	3	0	0	0	0	3
P/TOT	218	20	1	1	2	242	246	529	47	4	0	1	581	584	32	3	0	0	0	35

	MOVEMENT 7							MOVEMENT 8							MOVEMENT 9					
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT
16:00	7	2	0	0	1	10	11	24	7	0	0	0	31	31	0	0	0	0	0	0
16:15	4	3	0	0	0	7	7	41	8	2	0	0	51	52	0	0	0	0	0	0
16:30	11	0	0	0	0	11	11	43	7	0	0	0	50	50	0	1	0	0	0	1
16:45	8	2	0	0	0	10	10	53	5	0	0	0	58	58	1	0	0	0	0	1
H/TOT	30	7	0	0	1	38	39	161	27	2	0	0	190	191	1	1	0	0	0	2
17:00	10	0	0	0	0	10	10	47	3	1	0	0	51	52	1	0	0	0	0	1
17:15	16	2	0	0	1	19	20	46	4	1	0	0	51	52	1	0	0	0	0	1
17:30	6	0	0	0	0	6	6	36	3	1	0	0	40	41	1	0	0	0	0	1
17:45	18	1	0	0	0	19	19	28	0	0	0	0	28	28	1	0	0	0	0	1
H/TOT	50	3	0	0	1	54	55	157	10	3	0	0	170	172	4	0	0	0	0	4
18:00	15	1	0	0	0	16	16	25	3	0	0	0	28	28	3	0	0	0	0	3
18:15	5	2	1	0	1	9	11	34	4	0	0	0	38	38	1	0	0	0	0	1
18:30	6	1	0	0	0	7	7	25	1	0	0	0	26	26	0	0	0	0	0	0
18:45	5	1	0	0	0	6	6	24	3	0	0	0	27	27	1	0	0	0	0	1
H/TOT	31	5	1	0	1	38	40	108	11	0	0	0	119	119	5	0	0	0	0	5
P/TOT	111	15	1	0	3	130	134	426	48	5	0	0	479	482	10	1	0	0	0	11

2023 CARRIGALINE TRAFFIC COUNTS **MAY 2023**

/097 MANUAL CLASSIFIED JUNCTION TURNING COUNTS **TRA/23/097**

2023 SITE: 01 DATE: 3rd May 2023

esday LOCATION: Ballinrea Road/L2473 DAY: Wednesday

		MOVEMENT 10							MOVEMENT 11							MOVEMENT 12						
PCU	TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
0	07:00	0	0	0	0	0	0	0	6	2	0	0	0	8	8	1	1	0	0	0	2	2
0	07:15	0	0	0	0	0	0	0	8	0	0	1	0	9	10	5	0	0	0	0	5	5
0	07:30	0	0	0	0	0	0	0	11	0	1	1	0	13	15	8	2	0	0	0	10	10
0	07:45	4	0	0	0	0	4	4	10	0	0	1	0	11	12	4	1	0	0	0	5	5
0	**H/TOT**	4	0	0	0	0	4	4	35	2	1	3	0	41	45	18	4	0	0	0	22	22
4	08:00	9	1	0	0	0	10	10	14	1	0	1	0	16	17	4	2	0	0	0	6	6
4	08:15	24	0	0	0	0	24	24	23	1	2	2	0	28	32	7	2	0	0	0	9	9
9	08:30	44	1	0	0	0	45	45	28	2	1	2	0	33	36	5	3	0	0	0	8	8
15	08:45	17	0	0	0	0	17	17	29	2	0	1	0	32	33	5	1	0	0	0	6	6
32	**H/TOT**	94	2	0	0	0	96	96	94	6	3	6	0	109	118	21	8	0	0	0	29	29
1	09:00	3	0	0	0	0	3	3	13	0	3	0	0	16	18	0	2	0	0	0	2	2
1	09:15	1	0	0	0	0	1	1	5	4	1	2	0	12	15	4	2	0	0	0	6	6
1	09:30	1	0	0	0	0	1	1	8	1	1	2	0	12	15	7	0	0	0	0	7	7
0	09:45	0	0	0	0	0	0	0	6	1	0	2	0	9	12	1	0	0	0	0	1	1
3	**H/TOT**	5	0	0	0	0	5	5	32	6	5	6	0	49	59	12	4	0	0	0	16	16
35	**P/TOT**	103	2	0	0	0	105	105	161	14	9	15	0	199	223	51	16	0	0	0	67	67

		MOVEMENT 10							MOVEMENT 11							MOVEMENT 12						
PCU	TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
0	16:00	5	0	0	0	0	5	5	26	5	1	2	0	34	37	22	3	0	0	0	25	25
0	16:15	6	0	0	0	0	6	6	26	5	0	1	0	32	33	19	0	0	0	0	19	19
1	16:30	3	0	0	0	0	3	3	31	10	1	2	0	44	47	16	3	0	0	0	19	19
1	16:45	2	0	0	0	0	2	2	33	4	2	1	0	40	42	15	2	0	0	0	17	17
2	**H/TOT**	16	0	0	0	0	16	16	116	24	4	6	0	150	160	72	8	0	0	0	80	80
1	17:00	8	1	0	0	0	9	9	30	4	1	0	0	35	36	18	3	1	0	0	22	23
1	17:15	8	1	0	0	0	9	9	32	3	2	0	0	37	38	13	0	0	0	0	13	13
1	17:30	3	0	0	0	0	3	3	37	3	1	0	0	41	42	18	2	0	0	0	20	20
1	17:45	3	0	0	0	0	3	3	37	1	2	0	0	40	41	12	1	0	0	0	13	13
4	**H/TOT**	22	2	0	0	0	24	24	136	11	6	0	0	153	156	61	6	1	0	0	68	69
3	18:00	1	0	0	0	0	1	1	33	5	0	0	0	38	38	13	0	0	0	0	13	13
1	18:15	1	0	0	0	0	1	1	24	3	0	0	0	27	27	8	0	0	0	0	8	8
0	18:30	3	0	0	0	0	3	3	25	2	0	0	0	27	27	4	1	0	0	0	5	5
1	18:45	2	0	0	0	0	2	2	16	0	0	0	0	16	16	10	1	0	0	0	11	11
5	**H/TOT**	7	0	0	0	0	7	7	98	10	0	0	0	108	108	35	2	0	0	0	37	37
11	**P/TOT**	45	2	0	0	0	47	47	350	45	10	6	0	411	424	168	16	1	0	0	185	186

TRAFFINOMICS LIMITED

CARRIGALINE TRAFFIC COUNTS **MAY 2023**

MANUAL CLASSIFIED JUNCTION TURNING COUNTS **TRA/23/097**

SITE: 02 DATE: 3rd May 2023

LOCATION: Fernhill Road/Raffeen DAY: Wednesday

	MOVEMENT 1							MOVEMENT 2							MOVEMENT 3						
TIME	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**
07:00	1	0	0	0	0	1	1	68	10	0	0	0	78	78	15	1	0	0	0	16	16
07:15	1	0	0	0	0	1	1	103	5	0	0	0	108	108	15	3	0	0	0	18	18
07:30	1	1	0	0	0	2	2	88	15	0	0	0	103	103	21	2	0	0	0	23	23
07:45	2	0	0	0	0	2	2	104	10	0	0	0	114	114	18	1	1	0	0	20	21
H/TOT	5	1	0	0	0	6	6	363	40	0	0	0	403	403	69	7	1	0	0	77	78
08:00	1	0	0	0	0	1	1	78	6	1	0	0	85	86	20	0	0	0	0	20	20
08:15	0	0	0	0	0	0	0	89	4	0	0	0	93	93	28	0	1	0	0	29	30
08:30	0	0	0	0	0	0	0	84	2	0	0	0	86	86	54	2	0	0	0	56	56
08:45	2	0	0	0	0	2	2	43	4	0	0	0	47	47	28	2	0	0	1	31	32
H/TOT	3	0	0	0	0	3	3	294	16	1	0	0	311	312	130	4	1	0	1	136	138
09:00	0	0	0	0	0	0	0	19	3	0	0	0	22	22	30	1	0	0	0	31	31
09:15	0	0	0	0	0	0	0	14	5	0	0	0	19	19	14	1	0	0	0	15	15
09:30	0	0	0	0	0	0	0	13	2	0	0	0	15	15	17	3	0	0	0	20	20
09:45	0	0	0	0	0	0	0	11	3	1	0	0	15	16	9	0	0	0	0	9	9
H/TOT	0	0	0	0	0	0	0	57	13	1	0	0	71	72	70	5	0	0	0	75	75
P/TOT	8	1	0	0	0	9	9	714	69	2	0	0	785	786	269	16	2	0	1	288	290

	MOVEMENT 1							MOVEMENT 2							MOVEMENT 3						
TIME	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**
16:00	1	0	0	0	0	1	1	14	0	0	0	0	14	14	27	7	1	0	0	35	36
16:15	0	0	0	0	0	0	0	25	1	0	0	0	26	26	40	4	0	0	0	44	44
16:30	0	0	0	0	0	0	0	15	1	0	0	0	16	16	63	6	1	0	0	70	71
16:45	1	0	0	0	0	1	1	24	3	0	0	0	27	27	64	6	1	0	0	71	72
H/TOT	2	0	0	0	0	2	2	78	5	0	0	0	83	83	194	23	3	0	0	220	222
17:00	1	0	0	0	0	1	1	32	4	0	0	0	36	36	79	3	0	0	0	82	82
17:15	0	0	0	0	0	0	0	31	2	0	0	0	33	33	49	2	0	0	0	51	51
17:30	0	0	0	0	0	0	0	34	2	0	0	0	36	36	37	1	0	0	0	38	38
17:45	1	0	0	0	0	1	1	36	1	0	0	0	37	37	21	0	0	0	0	21	21
H/TOT	2	0	0	0	0	2	2	133	9	0	0	0	142	142	186	6	0	0	0	192	192
18:00	0	0	0	0	0	0	0	19	1	0	0	0	20	20	29	1	0	0	0	30	30
18:15	0	0	0	0	0	0	0	22	1	0	0	0	23	23	13	4	0	0	0	17	17
18:30	0	0	0	0	0	0	0	21	3	0	0	0	24	24	16	2	0	0	0	18	18
18:45	0	0	0	0	0	0	0	24	1	0	0	0	25	25	14	2	0	0	0	16	16
H/TOT	0	0	0	0	0	0	0	86	6	0	0	0	92	92	72	9	0	0	0	81	81
P/TOT	4	0	0	0	0	4	4	297	20	0	0	0	317	317	452	38	3	0	0	493	495

TRAFFINOMICS LIMITED

CARRIGALINE TRAFFIC COUNTS **MAY 2023**

MANUAL CLASSIFIED JUNCTION TURNING COUNTS **TRA/23/097**

SITE: 02 DATE: 3rd May 2023

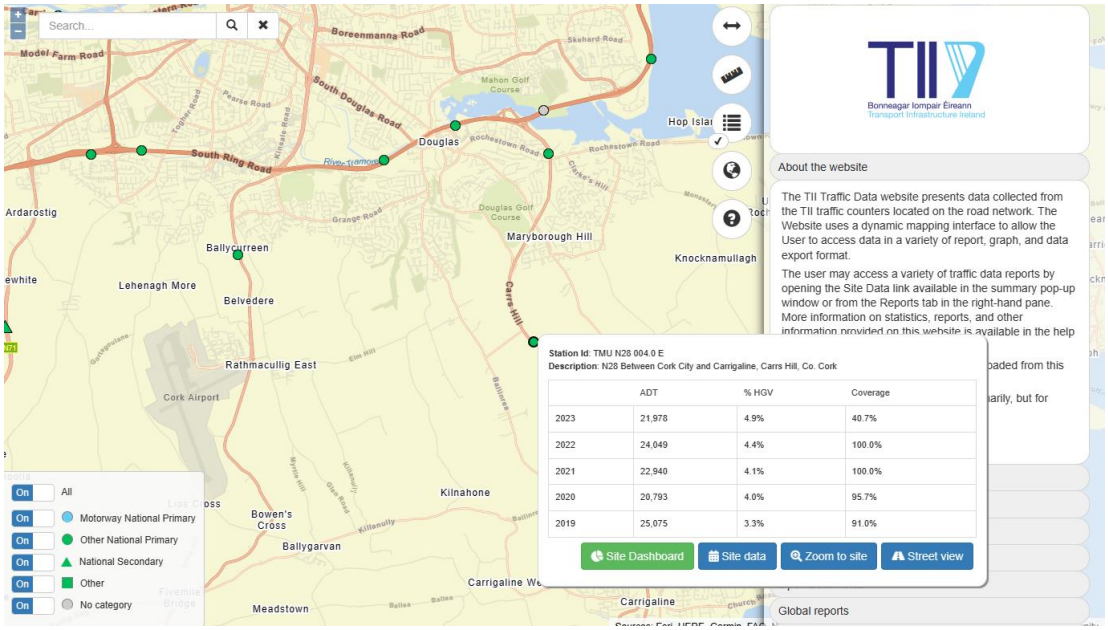
LOCATION: Fernhill Road/Raffeen DAY: Wednesday

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**
07:00	2	2	0	0	0	4	4	6	1	0	0	0	7	7	0	0	0	0	0	0	0
07:15	1	0	0	0	0	1	1	3	0	0	0	0	3	3	0	0	0	0	0	0	0
07:30	9	1	0	0	0	10	10	3	1	0	0	0	4	4	0	0	0	0	0	0	0
07:45	6	0	0	0	0	6	6	6	0	1	0	0	7	8	0	0	0	0	0	0	0
H/TOT	18	3	0	0	0	21	21	18	2	1	0	0	21	22	0	0	0	0	0	0	0
08:00	11	1	0	0	0	12	12	14	0	0	0	0	14	14	0	0	0	0	0	0	0
08:15	21	0	0	0	0	21	21	7	2	0	0	0	9	9	1	1	0	0	0	2	2
08:30	14	0	0	0	0	14	14	14	1	0	0	0	15	15	0	0	0	0	0	0	0
08:45	10	0	0	0	0	10	10	11	1	1	0	0	13	14	0	0	0	0	0	0	0
H/TOT	56	1	0	0	0	57	57	46	4	1	0	0	51	52	1	1	0	0	0	2	2
09:00	8	2	0	0	0	10	10	8	0	0	0	0	8	8	0	0	0	0	0	0	0
09:15	4	0	1	0	0	5	6	7	0	0	0	0	7	7	0	0	0	0	0	0	0
09:30	5	0	0	0	0	5	5	4	0	0	0	0	4	4	0	0	0	0	0	0	0
09:45	2	1	0	0	0	3	3	2	0	0	0	0	2	2	0	0	0	0	0	0	0
H/TOT	19	3	1	0	0	23	24	21	0	0	0	0	21	21	0	0	0	0	0	0	0
P/TOT	93	7	1	0	0	101	102	85	6	2	0	0	93	94	1	1	0	0	0	2	2

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**	**CAR**	**LGV**	**OGV1**	**OGV2**	**BUS**	**TOT**	**PCU**
16:00	6	0	0	0	0	6	6	4	0	0	0	0	4	4	0	0	0	0	0	0	0
16:15	5	1	0	0	0	6	6	10	3	0	0	0	13	13	1	0	0	0	0	1	1
16:30	12	2	0	0	0	14	14	11	1	0	0	0	12	12	0	0	0	0	0	0	0
16:45	9	0	0	0	0	9	9	13	3	0	0	0	16	16	1	0	0	0	0	1	1
H/TOT	32	3	0	0	0	35	35	38	7	0	0	0	45	45	2	0	0	0	0	2	2
17:00	5	1	0	0	0	6	6	12	4	0	0	0	16	16	2	0	0	0	0	2	2
17:15	3	1	0	0	0	4	4	7	1	0	1	0	9	10	0	0	0	0	0	0	0
17:30	4	0	0	0	0	4	4	13	2	0	0	0	15	15	2	0	0	0	0	2	2
17:45	5	1	1	0	0	7	8	23	1	0	0	0	24	24	4	0	0	0	0	4	4
H/TOT	17	3	1	0	0	21	22	55	8	0	1	0	64	65	8	0	0	0	0	8	8
18:00	8	0	0	0	0	8	8	13	0	0	0	0	13	13	0	0	0	0	0	0	0
18:15	4	1	0	0	0	5	5	10	2	0	0	0	12	12	0	0	0	0	0	0	0
18:30	4	0	0	0	0	4	4	8	1	0	0	0	9	9	0	0	0	0	0	0	0
18:45	5	0	0	0	0	5	5	6	2	0	0	0	8	8	0	0	0	0	0	0	0
H/TOT	21	1	0	0	0	22	22	37	5	0	0	0	42	42	0	0	0	0	0	0	0
P/TOT	70	7	1	0	0	78	79	130	20	0	1	0	151	152	10	0	0	0	0	10	10

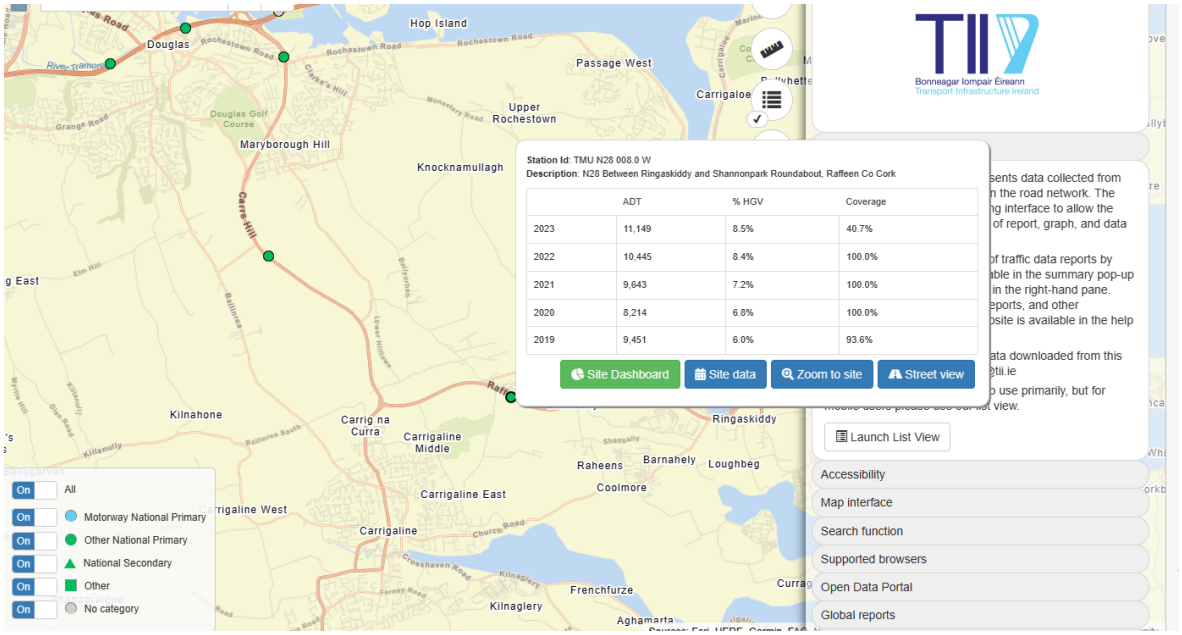
Appendix B

TII Automatic Traffic Count Data for the N28



All Lanes ▾ | Time Period: 1 hour ▾ | Class: Any ▾ | Exclude data: None ▾

	Average Daily Flow
00:00	106
01:00	63
02:00	49
03:00	52
04:00	72
05:00	261
06:00	1141
07:00	1670
08:00	1434
09:00	1239
10:00	1217
11:00	1360
12:00	1492
13:00	1600
14:00	1730
15:00	1854
16:00	1940
17:00	1827
18:00	1516
19:00	1069
20:00	672
21:00	427
22:00	287
23:00	182
07-19	18879
06-22	22189
06-24	22658
00-24	23261
am Peak	07:00
Peak Volume	1670
Peak Factor	0.969
pm Peak	16:00
Peak Volume	1940
Peak Factor	0.979



All Lanes ▾ | Time Period: 1 hour ▾ | Class: Any ▾ | Exclude data: None ▾

	Average Daily Flow
00:00	25
01:00	18
02:00	16
03:00	27
04:00	36
05:00	152
06:00	839
07:00	963
08:00	723
09:00	444
10:00	409
11:00	468
12:00	552
13:00	576
14:00	663
15:00	740
16:00	896
17:00	727
18:00	716
19:00	384
20:00	150
21:00	100
22:00	70
23:00	50
07-19	7878
06-22	9351
06-24	9471
00-24	9745
am Peak	07:00
Peak Volume	963
Peak Factor	0.888
pm Peak	16:00
Peak Volume	896
Peak Factor	0.957

Appendix C

Additional Tables for Information

Table C1	Proposed detours by grid route section, distance and time (for sections on public road)
Table C2	Traffic impact due to trench excavation and grid construction on carriageway – additional time and distance
Table C3	Traffic impact due to crossing watercourses – additional time and distance
Table C4	Traffic impact due to joint bays – additional time and distance
Table C5	Traffic impact due to all works – additional time and distance Table

Table C1 Proposed detours by grid route section, distance and time (sections on public road network)

Section	Description	Link length	Distance of trip A to B Existing	Distance of trip A to B Diversion	Ave detour per vehicle (kms)	Ave detour per vehicle (hours)	Ave detour per vehicle (mins)
1	Local access off road	0.73	NA	NA	NA	NA	NA
2	L-2464	1.16	3.97	4.97	1.00	0.02	1.20
3	L-2473	0.84	0.90	2.71	1.81	0.04	2.17
4a	off road	0.49	NA	NA	NA	NA	NA
4b	N28 (n)	0.19	0.19	0.19	0.00	0.00	0.00
5	N28 (e)	0.49	0.49	0.49	0.00	0.00	0.00
6	L-2490	0.28	1.51	2.84	1.33	0.03	1.60
7	off road	0.18	NA	NA	NA	NA	NA
8	L-2490	1.05	1.51	2.84	1.33	0.03	1.60
9	Raffeen local road	0.72	1.68	2.67	1.95	0.04	2.34
10	Local access off road	0.49	NA	NA	NA	NA	NA
Total		6.62					

Table C2 Traffic impact due to trench excavation and grid construction on carriageway - additional time and distance

								Impacts of detour				
Section	**Description**	**Road type**	**Length (kms)**	**Main Road TMM**	**Duration in days (based on 100m / day)**	**Daily flow impacted**	**Total trips impacted**	**Ave detour per vehicle (kms)**	**Total detour veh kms / day**	**Total detour veh kms in total**	**Total detour veh hours / day**	**Total detour veh hours in total**
1	Local access off road	Narrow - 2 lane	0.73	Off road	7.3	0	0	NA	NA	NA	NA	NA
2	L-2464	Narrow - 2 lane	1.16	Closure	11.6	7,058	81,873	1.00	7,058	81,873	141	1,637
3	L-2473	Narrow - 2 lane	0.84	Closure	8.4	4,647	39,035	1.81	8,411	70,653	168	1,413
4a	Off road	Off road	0.49	Off road	4.9	0	0	NA	NA	NA	NA	NA
4b	N28 (n)	Wide - 2 lane + cycle lane + verge	0.19	Retain 2-way	1.9	0	0	0.00	0	0	0	0
5	N28 (e)	Type 1 Dual	0.49	Retain 2-way	4.9	0	0	0.00	0	0	0	0
6	L-2490	Narrow - 2 lane	0.28	Closure	2.8	4,724	13,227	1.33	6,283	17,592	126	352
7	off road	Off road	0.18	Off road	1.8	0	0	NA	NA	NA	NA	NA
8	L-2490	Narrow - 2 lane	1.05	Closure	10.5	4,724	49,602	1.33	6,283	65,971	126	1,319
9	Raffeen local road	Narrow - 2 lane	0.72	Closure	7.2	1,109	7,985	1.95	2,163	15,570	43	311
10	Local access off road	Narrow - 2 lane	0.49	Off road	4.9	0	0	NA	NA	NA	NA	NA
Total			6.62		66.2	22,262	191,722		30,197	251,659	604	5,033

Table C3 Traffic impact due to crossing watercourses - additional time and distance

								Impacts of detour			
Section	**Description**	**Road type**	**Stream crossings / culvert crossings / bridge HDD locations**	**Main Road TMM**	**Duration in days (3 days / location)**	**Daily flow impacted**	**Total trips impacted**	**Ave detour per vehicle (kms)**	**Total detour veh kms / day**	**Total detour veh kms in total**	**Total detour veh hours / day**	**Total detour veh hours in total**
1	Local access off road	Narrow - 2 lane	0	Off road	0	0	0	NA	NA	NA	NA	NA
2	L-2464	Narrow - 2 lane	1	Closure	3	7,058	21,174	1.00	7,058	21,174	141	423
3	L-2473	Narrow - 2 lane	1	Closure	3	4,647	13,941	1.81	8,411	25,233	168	505
4a	Off road	Off road	0	Off road	0	0	0	NA	NA	NA	NA	NA
4b	N28 (n)	Wide - 2 lane + cycle lane + verge	2	Retain 2-way	6	0	0	0.00	0	0	0	0
5	N28 (e)	Type 1 Dual	0	Retain 2-way	0	0	0	0.00	0	0	0	0
6	L-2490	Narrow - 2 lane	0	Closure	0	4,724	0	1.33	6,283	0	126	0
7	off road	Off road	1	Off road	3	0	0	NA	NA	NA	NA	NA
8	L-2490	Narrow - 2 lane	0	Closure	0	4,724	0	1.33	6,283	0	126	0
9	Raffeen local road	Narrow - 2 lane	0	Closure	0	1,109	0	1.95	2,163	0	43	0
10	Local access off road	Narrow - 2 lane	0	Off road	0	0	0	NA	NA	NA	NA	NA
Total			5		15		35,115		30,197	46,407	604	928

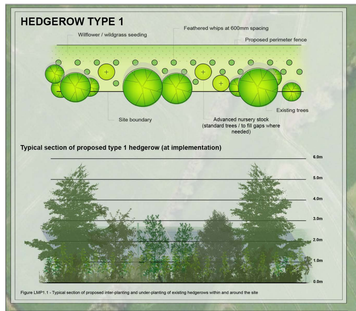
Table C4 Traffic impact due to joint bays - additional time and distance

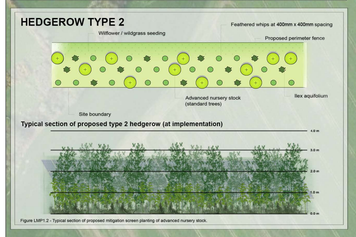
								Impacts of detour				
Section	**Description**	**Road type**	**Joint bays**	**Main Road TMM**	**Duration in days (6 days / location)**	**Daily flow impacted**	**Total trips impacted**	**Ave detour per vehicle (kms)**	**Total detour veh kms / day**	**Total detour veh kms in total**	**Total detour veh hours / day**	**Total detour veh hours in total**
1	Local access off road	Narrow - 2 lane	0	Off road	0	0	0	NA	NA	NA	NA	NA
2	L-2464	Narrow - 2 lane	2	Closure	12	7,058	84,696	1.00	7,058	84,696	141	1,694
3	L-2473	Narrow - 2 lane	2	Closure	12	4,647	55,764	1.81	8,411	100,933	168	2,019
4a	Off road	Off road	1	Off road	6	0	0	NA	NA	NA	NA	NA
4b	N28 (n)	Wide - 2 lane + cycle lane + verge	0	Retain 2-way	0	0	0	0.00	0	0	0	0
5	N28 (e)	Type 1 Dual	1	Retain 2-way	6	0	0	0.00	0	0	0	0
6	L-2490	Narrow - 2 lane	0	Closure	0	4,724	0	1.33	6,283	0	126	0
7	off road	Off road	0	Off road	0	0	0	NA	NA	NA	NA	NA
8	L-2490	Narrow - 2 lane	2	Closure	12	4,724	56,688	1.33	6,283	75,395	126	1,508
9	Raffeen local road	Narrow - 2 lane	1	Closure	6	1,109	6,654	1.95	2,163	12,975	43	260
10	Local access off road	Narrow - 2 lane	0	Off road	0	0	0	NA	NA	NA	NA	NA
Total			9		54		203,802		30,197	273,999	604	5,480

Table C5 Traffic impact due to all work - additional time and distance

							Impacts of detour				
Section	**Description**	**Road type**	**Main Road TMM**	**Total duration**	**Daily flow impacted**	**Trips impacted**	**Ave detour per vehicle (kms)**	**Total detour veh kms / day**	**Total detour veh kms in total**	**Total detour veh hours / day**	**Total detour veh hours in total**
1	Local access off road	Narrow - 2 lane	Off road	7.3	0	0	NA	NA	NA	NA	NA
2	L-2464	Narrow - 2 lane	Closure	26.6	7,058	187,743	1.00	7,058	187,743	141.2	3,755
3	L-2473	Narrow - 2 lane	Closure	23.4	4,647	108,740	1.81	8,411	196,819	168.2	3,936
4a	Off road	Off road	Off road	10.9	0	0	NA	NA	NA	NA	NA
4b	N28 (n)	Wide - 2 lane + cycle lane + verge	Retain 2-way	7.9	0	0	0.00	0	0	0	0
5	N28 (e)	Type 1 Dual	Retain 2-way	10.9	0	0	0.00	0	0	0.0	0
6	L-2490	Narrow - 2 lane	Closure	2.8	4,724	13,227	1.33	6,283	17,592	125.7	352
7	off road	Off road	Off road	4.8	0	0	NA	NA	NA	NA	NA
8	L-2490	Narrow - 2 lane	Closure	22.5	4,724	106,290	1.33	6,283	141,366	125.7	2,827
9	Raffeen local road	Narrow - 2 lane	Closure	13.2	1,109	14,639	1.95	2,163	28,546	43.3	571
10	Local access off road	Narrow - 2 lane	Off road	4.9	0	0	NA	NA	NA	NA	NA
Total				135.2		430638		30,197	572,065	604	11,441
Average									1.33		0.027

Appendix 4: Biodiversity Management Plan Ballinrea Solar Farm





Hedgerow type 2 consisting of a native whip planting mix and advanced nursery stock. Hedgerow to be maintained at a height of approximtely 4m to screen views from road users and residential dwellings to the west.

Figure: BT1

Hedgerow Type 1 (standard) - Perimeter and internal hedgerows to be bolstered with additional planting. Hedges will be maintained to a height of 4 metres, helping to screen the panels from view while also improving biodiversity on site. Advanced nursery stock will only be used to plug gaps as necessary

Section of existing hedgerow to be re-moved during construction period to facilitate clear sightlines of 90m.

Hedgerow to be reinstated post construction stage

New section of hedgerow to surround heritage feature comprising of advanced nursery stock to be managed to a height of approximately 1.5m.

Introduction of hedgerow to screen distant uphill panels and provide vegetated skyline

All advanced nursery stock is to be provided as Crataegus monogyna (Hawthorn) at 10-12cm girth (c.3m) bare root standard trees.

Panels omitted from steepest uphill section of view from south/west

Figure: BT4

Note: Refer to boundary treatment drawing LD.BLNREA 3.2 for figures BT1-4.

Figure: BT2

Figure: BT3

Hedgerow type 2 consisting of a native whip planting mix and advanced nursery stock. Hedgerow to be maintained at a height of approximtely 4m to screen views from road users and residential dwellings to the west.

Reponse to RFI Item 10: New proposed section of hedgerow type 2, consisting of a native whip planting mix and advanced nursery stock, to flank the proposed security fence along the southern boundary of site. Newly proposed hedgerow will connect with the existing bolstered hedgerows in the south-eastern extents of the site.

All advanced nursery stock is to be provided as Crataegus monogyna (Hawthorn) at 10-12cm girth (c.3m) bare root standard trees. Hedgerow to be maintained at a height of approximtely 4m.

0m 75m 150m

LEGEND:

- Hedgerow Type 1
- Hedgerow Type 2
- Wild grass seeding
- Existing hedgerows
- Exisiting drainage
- Existing trees
- Advanced nursery stock
- Proposed fence
- Overhead cables
- Inverter stations
- Access tracks
- CCTV
- Site boundary

NOTES:

The function of the proposed mitigation planting is primarily for screening, but it will also enhance the ecological corridors that are already present within the hedgerows.

Mitigation screen planting shall consist of a mixture of native hedgerow species that are prevalent in the immediate area. Planting to consist of feathered whips (of various sizes) and advanced nursery stock* in staggered rows at a spacing of 600mm.

'Under-planting' to consist of a single row of whips to the development side of existing tree lines and hedgerows.

'Inter-planting' to consist of whips at 600mm centres to fill gaps in existing tree lines and hedgerows.

New sections of hedgerow to consist of a triple staggered row of whips and advanced nursery stock* at 600mm spacing.

All native species will be planted as whips, with the primary and secondary structure species to be of a minimum height of 80-100cm and the other shrubs species to be of a minimum height of 40-60cm.

Proposed mitigation screen planting to be planted as per diagram LMP1.1-1.2 and maintained at a height of 3-4m.

Wildflower / Wild grass seeding of local provenance to occupy any residual space between perimeter fence and nearest line of whip planting.

Species mix to be finalised in conjunction with the project ecologist.

All species will be from certified native stock and preferably from an approved supplier of the *Green, Low-Carbon, Agri Environment Scheme* (GLAS).

***Advanced nursery stock to be provided as *Crataegus monogyna* (Hawthorn) at 10-12cm girth (c. 3m) bare root standard trees.**

NATIVE HEDGEROW SPECIES:

Botanical name	Common name	Size	%
Primary structure;			
Crataegus monogyna	Hawthorn	1+2tr 80-100cm / 10-12cm girth 3m br standard trees	60%
Secondary structure;			
Prunus spinosa	Blackthorn	1+2tr 80-100cm	15%
Ilex aquifolium	Holly	1+2tr 80-100cm	15%
Shrub species structure;			
Rubus fruticosus	Bramble	1+1tr 40-60cm	2.5%
Corylus avellana	Hazel	1+1tr 40-60cm	2.5%
Rosa canina	Dog-rose	1+1tr 40-60cm	2.5%
Euonymus europaeus	Spindle	1+1tr 40-60cm	2.5%

macroworks

Ground Floor, Hibernia House
Cherrywood Business Park
Loughlinstown, Dublin 18
Ireland
00353 (01) 2303585
info@macroworks.ie

PROJECT:
Ballinrea Solar Farm,
Ballinrea,
County Cork. (RFI)

CLIENT:
TERRA SOLAR II

DRAWING:
Landscape Mitigation Plan (RFI)

SCALE:
1:2500

DATE:
September 2018

DWN BY:
CD

CKD BY:
RB

SHEET SIZE:
A1 (landscape)

DWG No.
LD.BLNREA 3.1

Appendix 5: Archaeological Mitigation Strategy

Archaeological Resolution Strategy Document to facilitate a 110kV Substation at Ballinrea Townland, Co. Cork

Project Code: RH0889
Client: Ballinrea Solar Farm Ltd
Author: Enda O'Flaherty
Date: 20 December 2024
Version: 0.1

Rubicon Heritage

VERSION CONTROL

Version	Date	Description	By	Approved By
1.0	18/12/2024	Draft	EOF	

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Figure 1 Proposed Substation Location (Area 6)
Figure 2 Location of isolated features identified in preceding testing a proposed for 'Preservation by record'

REFERENCE SHEET FOR PLANNING AUTHORITY

Planning Ref. No.: Ballinrea Solar Farm (Pl. Ref. 17/6784, ABP Ref. (ABP 303013-18).)

Associated Planning Condition No. Condition 8c, d and e only

National Grid Ref. (ITM): 571493, 565208

Townland/s: Ballinrea

Town/ City: NA

County: Cork

Postal Address (if applicable):N/A

Planning Authority: Cork County Council

Relevant RMP No. NA

Summary: Please see Executive Summary

1. EXECUTIVE SUMMARY

The purpose of this document is to outline the proposed archaeological resolution strategy pertaining to Condition 8c, d and e in respect of the groundworks required to facilitate a Strategic Infrastructure Development (SID) at Ballinrea and adjacent townlands, Co. Cork. (Figure 1). This resolution strategy document was undertaken for Ballinrea Solar Farm Ltd.by Rubicon Heritage Services Ltd.

The proposed development comprises of a 110 kV substation at the permitted Ballinrea Solar Farm (Pl. Ref. 17/6784, ABP Ref. (ABP 303013-18).), a tail fed underground grid connection from the proposed 110kV substation to the existing Raffeen 220 KV substation, a proposed new 110kV cable bay at the existing Raffeen 220kV Substation and associated works.

The proposed development is situated south of Cork City, in the townland of Ballinrea (the location of the proposed substation), with the proposed underground grid connection crossing through the townlands of Ardnacloghy, Shannonpark, Hilltown, Carrigaline Middle, Ballymiken, Carrigaline and Rafeen.

A preceding geophysical survey (for planning Ref. 17/06784) and subsequent targeted programme of archaeological test trenching (License No. 23E0323) identified a number of small, isolated pits (6 No.) and postholes (5 No.) within the footprint of the proposed substation at Ballinrea.

A preceding archaeological assessment (License No. 23E0323) identified the presence of isolated archaeological deposits within the footprint of the proposed substation at Ballinrea. It was proposed that, where feasible archaeological features and deposits identified during test-trenching works should be preserved *in-situ*. Where preservation *in-situ* was not possible, it was recommended that all archaeological features impacted by the proposed development are stripped of topsoil under archaeological supervision and preserved by record (archaeological excavation) in advance of construction.

In relation to Condition 8c it is now clear that it will not be feasible to preserve *in situ*, the isolated archaeological deposits identified during test trenching at the proposed substation location. These deposits comprised: 6 No(s). Possible Post Holes, and 5 No(s). Possible Pits.

It is proposed here that:

- The footprint of the proposed substation is mechanically stripped of topsoil under archaeological supervision and

- A programme of full archaeological excavation is undertaken, to ensure the preservation by record of the previously identified features (6 No(s). Possible Post Holes, and 5 No(s). Possible Pits). This work will be carried out by a team of suitably qualified archaeologists under licence and in accordance with the provisions of the National Monuments Acts 1930-2014

- Should archaeological features additional to those already-known deposits be discovered during the course of monitoring, a strategy will be proposed to the County Archaeologist and National Monuments Service for full archaeological excavation to ensure the preservation by record.

In relation to Condition 8d The developer has appointed Rubicon Heritage to monitor groundworks on all previously undisturbed ground outside of the modern roadway (such as road verge or greenfield) under License Number 24E0662.

Monitoring will also be undertaken under the same license where cable route cross the Zone of Notification for two RMP sites (CO086-062----& CO087-116----).

In relation to Condition 8e This document proposes a resolution strategy for Conditions 8c and 8d. On acceptance of this proposed resolution strategy, the developer considers the pre-commencement requirements for Condition 8e to be in compliance. All other advance conditions (8f-8i) will be adhered to as required prior to construction.

In respect of the archaeological exclusion zones to be set out, the developer has appointed Rubicon Heritage to liaise with the Local Authority archaeologist and establish the previously agreed buffer zones prior to the commencement of construction.

Subsequent to the completion of archaeological works, and in compliance with conditions of licensed monitoring and excavation, the results of any and all archaeological test trenching, monitoring, surveys and/or excavation will be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland.

2. Summary of archaeological work undertaken to date

A previous archaeological assessment (O'Flaherty 2024) identified 103 sites of archaeological, and/or cultural heritage significance within the defined study areas. These sites include 28 RMPs (CH001–CH028), two NIAH registrations (CH029 and CH030) seven townland boundaries (CH091–CH097), four unregistered cultural heritage sites (CH098–CH101), and 61 previous archaeological excavations (CH031–CH090; CH102 and CH103).

A preceding geophysical survey (for planning Ref. 17/06784) and subsequent targeted programme of archaeological test trenching (License No. 23E0323) identified a number of small, isolated pits (6 No.) and postholes (5 No.) within the footprint of the proposed substation at Ballinrea.

3. Cork County Council Correspondence

Cork County Council issued correspondence on 05/12/2023 (Appendix 2) pertaining in part, to the resolution of archaeological conditions imposed on the development. This included the following:

(b) The developer shall engage a suitably qualified archaeologist (licensed under the National Monuments Acts) to carry out pre-development archaeological testing in areas of proposed ground disturbance within the greenfield portion of the scheme and to submit an archaeological impact assessment report for the written agreement of the planning authority, following consultation with the National Monuments Service, in advance of any site preparation works or groundworks, including site investigation works/topsoil stripping/ site clearance and/or construction works.

Rubicon Heritage Services Ltd were engaged by the applicant to undertake Archaeological Testing of both the Substation site and the grid connection route.

*The **Grid connection** (green field areas only) section of the scheme was tested under licence 24E0662 Ewelina Rondelez in August 2024. Five test trenches were excavated and no finds of significance were identified. I consider the test trenches to be fairly limited in number and size although archaeological monitoring at the construction stage will seek to address any outstanding archaeological issues.*

The substation site had already been subject to previous testing (Rubicon) under licence 23E0323. The updated PECR report (October 2024, Enda O Flaherty) has specified that a targeted program of archaeological test trenching under license number 23E0323 identified a number of small isolated pits and post holes (CH102) within the footprint of the proposed Ballinrea Substation. The updated PECR and Impact Statement has specified that the proposed substation will have a direct permanent negative effect on any sub-surface remains (Page 29).

The Archaeological Impact Statement, required by Condition 8b is provided in the Table of Impacts on page 30 of the PECR.

(c) The report shall include an archaeological impact statement and mitigation strategy. Where archaeological material is shown to be present, avoidance, preservation in-situ, preservation by record [archaeological excavation] and/or monitoring may be required.

The Planning and Environmental Consideration Report has been updated to include the results of the testing of both the substation site and the grid connection route. The PECR (October 2024) has provided Mitigation measures in Section 5 of the report. The mitigation measures are somewhat open ended, however, considering that sub-surface features (isolated pits and posts) have been identified within the substation site (CH102). The archaeologist has proposed that the features identified within the sub-station site (Licence 23E0323) be either preserved in situ and where this is not feasible, preservation by record. The recommendations of the PECR report (page 31, section 5.1. recommends that a mitigation strategy be submitted to the Local Authority archaeologist clearly identifying the preservation strategy for features identified thus far.

Since this element of the scheme has not yet been agreed with the Local Authority by way of a formal compliance submission, this condition is not yet compliant. The applicant is advised to submit a definitive proposal for how the features within the sub-station are to be dealt with.

(d) Any further archaeological mitigation requirements specified by the planning authority, following consultation with the National Monuments Service, shall be complied with by the developer.

As above and the Archaeological Mitigation strategy should include Construction Stage archaeological monitoring in green field areas of the scheme and 'off-road' verges along the cable route and where the scheme passes ZoNs around RMPs and adjacent to the Limekiln (site of) identified in the testing report 24E0662 (grid connection route). Further agreements may have to be made regarding how any further/ new features are dealt with (either preservation in site or preservation by record).

(e) No site preparation and/or construction works shall be carried out on site until the archaeologist's report has been submitted to and approval to proceed is agreed in writing with the planning authority.

Although the 'archaeologist's report' (assumed in Condition 8 to refer to the 'Testing report'), has been submitted, approval to proceed in writing cannot be progressed in green areas until Condition 8c and d are finalised and agreed. Other advance conditions also apply prior to construction (Exclusions zones, CEMPs etc).

4. Proposed Resolution Strategy

Condition 8c
It is now clear that it will not be feasible to preserve *in situ,* the isolated archaeological deposits identified during test trenching at the proposed substation location. These deposits comprised: 6 No(s). Possible Post Holes, and 5 No(s). Possible Pits.

The below resolution strategy is proposed in order to address Condition 8c

It is proposed here that:

- The footprint of the proposed substation is mechanically stripped of topsoil under archaeological supervision and

- A programme of full archaeological excavation is undertaken, to ensure the preservation by record of the previously identified features. This work will be carried out by a team of suitably qualified archaeologists under licence and in accordance with the provisions of the National Monuments Acts 1930-2014

- Should archaeological features additional to those already-known deposits be discovered during the course of monitoring, a strategy will be proposed to the County Archaeologist and National Monuments Service for full archaeological excavation to ensure the preservation by record.

To facilitate the above, an application will be submitted to obtain a licence from the Department of Housing, Local Government and Heritage to undertake archaeological excavation. The total area proposed for stripping or topsoil will be 30,200 sq m approx. (corresponding the footprint of the proposed substation and associated compound). Archaeological monitoring and excavation will be undertaken in accordance with a submitted and approved method statement and the terms of a Licence to Excavate.

The results of any archaeological test trenching, monitoring, surveys and/or excavation will be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland

Reports will be carried out in accordance with DAHLG *Guidelines for Authors of Reports on Archaeological Excavations*. The report will contain the following information where applicable to the results of the archaeological excavation programme:

- Description of the site and location
- Summary of the development and relevant planning background
- Relevant archaeological and historical background
- Objectives and methodology used
- Results of the test trenching programme
- Relevant discussion
- Relevant illustrations
    - Site location
    - RMP mapping

- Historic mapping
- Representative photos
- Scaled plans and drawings

The Licensed Director and/or Rubicon Heritage Services Ltd will issue the final report to the National Monuments Section of the Department of the Arts, Heritage and Gaeltacht and the National Museum of Ireland. A summary report will be published in the online Excavations Bulletin for 2024.

The archive generated by the work will be lodged with National Museum of Ireland, in approved format, once the facilities become available. The site archive and all materials recovered from the investigation will be temporarily housed in the Cork office of Rubicon Heritage Services Ltd.

Please note all the proposed resolutions are subject to approval of the National Monuments Service, National Museum of Ireland and the Cork County Council Archaeologist

Condition 8d
The developer has appointed Rubicon Heritage to monitor groundworks on all previously undisturbed ground outside of the modern roadway (such as road verge or greenfield) under License Number 24E0662.

Monitoring will also be undertaken under the same license where cable route cross the Zone of Notification for two RMP sites (CO086-062----& CO087-116----).

Should archaeological features or deposits be discovered during the course of monitoring, the extent of such features/deposits will be determined, a GPS location of the site will be established and works at this location will cease. A strategy will be proposed to the County Archaeologist and National Monuments Service to preserve the site *in situ*, where possible. Where preservation *in situ* cannot be achieved, either in whole or in part, then a programme of full archaeological excavation will be proposed, to ensure the preservation by record of the portion of the site that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under licence and in accordance with the provisions of the National Monuments Acts 1930-2014.

Where the proposed cable route passes the marked location of a Roadside Limekiln (ITM 57362, 564077), the cable trench will inspected by the monitoring archaeologist to ensure it is kept to the opposite (west) side of the carriageway to avoid impact on any sub-surface remains of this lime kiln.

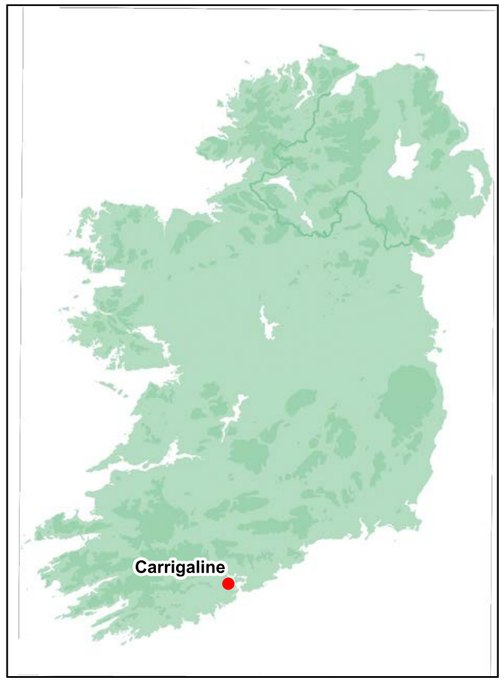
The results of any archaeological test trenching, monitoring, surveys and/or excavation will be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland.

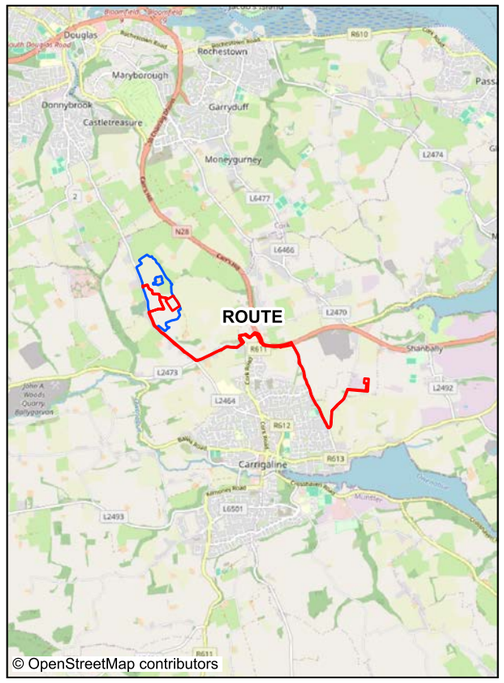
Condition 8e
This document proposes a resolution strategy for Conditions 8c and 8d. On acceptance of this proposed resolution strategy, the developer considers the pre-commencement requirements for Condition 8e to be in compliance. All other advance conditions (8f-8i) will be adhered to as required prior to construction. In respect of the archaeological exclusion zones to be set out, the developer has appointed Rubicon Heritage to liaise with the Local Authority archaeologist and establish the previously agreed buffer zones prior to the commencement of construction.

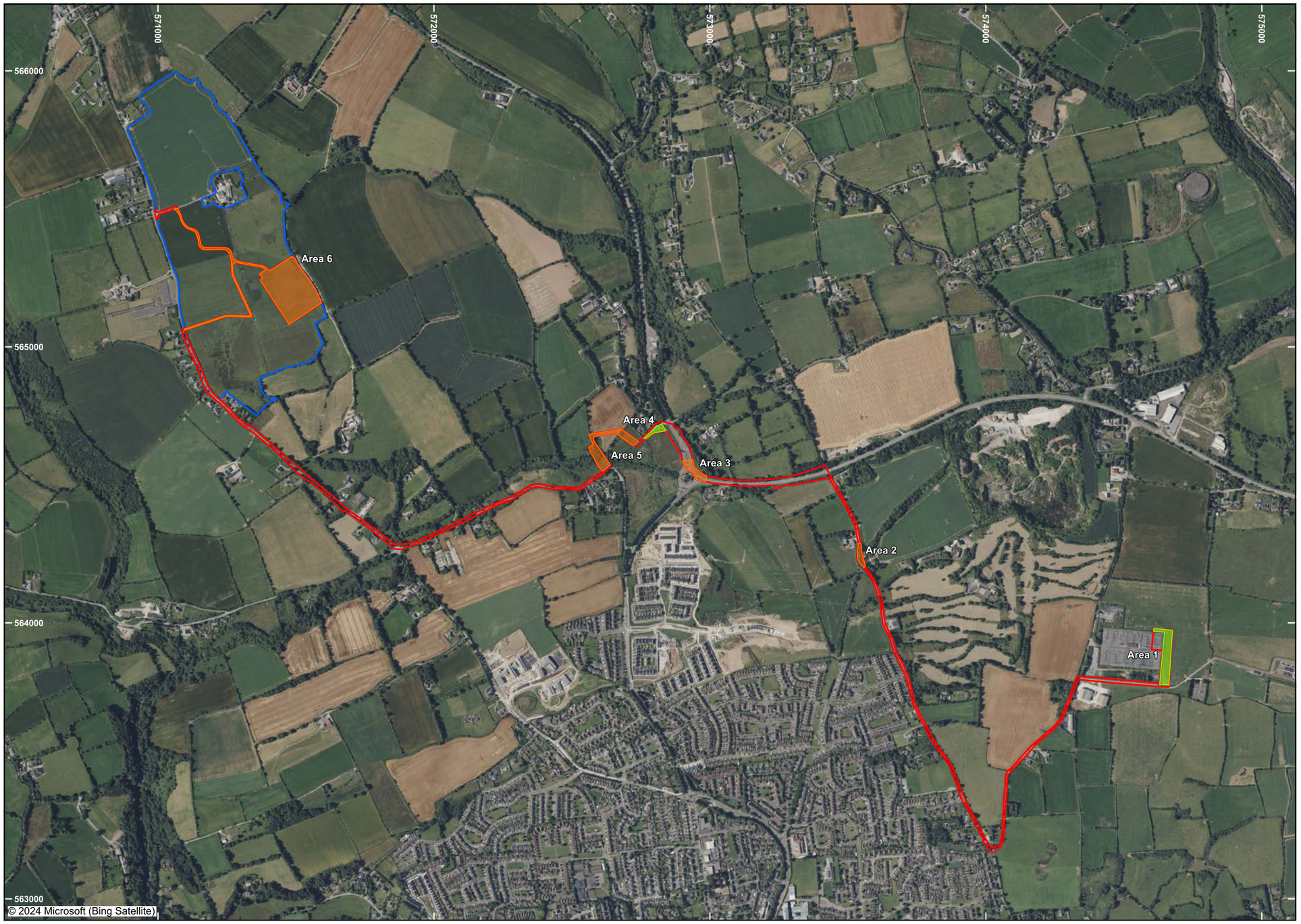
Subsequent to the completion of archaeological works, and in compliance with conditions of licensed monitoring and excavation, the results of any and all archaeological test trenching, monitoring, surveys and/or excavation will be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland.

APPENDIX 1. Previous Archaeological Testing Report

APPENDIX 2. Cork County Council issued correspondence







Legend

- Ballinrea - Land Ownership Boundary
- Grid Connection Route Boundary

Works Areas 1-6

- To be trenched
- Not being trenched

Project Code: RH0889 - Ballinrea Grid Connector		
Prepared by: H.Sims Approved by: B.Sutton	Status: Licence App Draft: N/A	Date: 22/05/2024 Scale: 1:15,000 @ A3

N

150 300 450 600 750 m

Rubicon Heritage

Figure 1 - Ballinrea Solar Array Grid Connection, Co. Cork: Site location and proposed development layout.



Ballinrea Grid Connector, Co. Cork

Aerial Mapping: © Microsoft 2024

Rubicon Heritage

KEY:

- Route boundary
- Proposed road
- Pipeline route
- Wayleave
- Area to be trenched
- Area not being trenched
- Previous test trench
- Previous testing feature

N

0 200m

Project Code: RH0889	Prepared by: H. Sims
Date: 22/05/2024	Checked by: B. Sutton
Scale: 1:4,000 @ A4	Approved by: B. Sutton

Figure 2 - Location of isolated features identified in preceding testing a proposed for 'Preservation by record'

APPENDIX 1. Previous Archaeological Testing Report

Final Report on the Results of Archaeological Test Trenching at Ballinrea, Carrigaline, Co. Cork 23E0323

Project Code: RH0786
Client: Ørsted
Date: 29 March 2024
Excavation Licence: 23E0323
Planning Reg No: 17/06784
Licensee: Jennifer McCarthy
Report Authors: Jennifer McCarthy and Dawn Gooney
National Grid Reference (ITM): E571300, N565553
Archaeological Consultant: Rubicon Heritage Services Ltd

Rubicon Heritage

VERSION CONTROL

Version	Date	Description	By	Approved By
0.1	01/11/2023	First draft of report	JMcC, DG	BS
0.2	16/11/2023	Edits returned	BS	
0.3	17/11/2023	Edits addressed	JMcC	BS
1.0	24/11/2023	Finalising for issue	BS	
2.0	29/03/2024	Amended to update planning decision	JMcC	BS

DISCLAIMER

This report was produced by Rubicon Heritage Services Ltd under the criteria set out by its Integrated Management System, which is ISO certified in Quality (ISO 9001:2015), Environmental (ISO 14001:2015), Occupational Health and Safety (ISO 45001:2018) by external auditor – DQS GmbH. The report itself was not audited or certified.

Please note that the archaeological recommendations, mitigation proposals and methodology followed in this report are like those used on previous similar projects approved by the Archaeological Planning and Licencing Unit, National Monuments Service, Room G50, Custom House, Dublin 1. The National Monuments Acts 1930-2014, The Planning and Development Act 2000 (plus any amendments) and the most recent EPA guidelines were consulted. Guidelines and Plans issued from time-to-time by the statutory bodies have also been consulted. These are listed in the reference section of this report (DAHGI 1999a; 1999b; EPA 2003; 2017; IAI 2006; NMS 2006). A geophysical survey was carried out prior to the archaeological testing (Gimson 2018).

The archaeological test-trenching has been undertaken under licence, which required an approved method statement. Every effort has been taken in the preparation and submission of this report to provide as complete an assessment as possible within the terms of the brief, and all statements and opinions are offered in good faith. However, Rubicon cannot accept responsibility for errors of fact or opinion resulting from the data supplied by any third party, for any loss or other consequences arising from decisions made or actions taken on the basis of facts and opinions expressed in this report, (and any supplementary information), howsoever such facts and opinions may have been derived, or as the result of unknown and undiscovered sites or artefacts.

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ABBREVIATIONS AND TERMS USED

Barony, Parish, Townland	These terms refer to land divisions in Ireland. The barony is the largest land division in a county, which is formed from a number of parishes. These parishes are in turn made up of several townlands, which are the smallest land division in the country. The origins of these divisions are believed to be in the early medieval/Christian period (AD 500–1000) or may date earlier in the Iron Age (500 BC–AD 500).
DHLGH	Department of Housing, Local Government and Heritage
E	East
First Edition	This relates to the OS 6-inch maps for each county. The first edition map completed for the area dates to the early 1840s and this is referred to in the text as the '6-inch map.
km	Kilometre
m	Metres, all dimensions are given in metres or part of a metre, unless otherwise stated
N	North
NGR	National Grid Reference
NIAH	National Inventory of Architectural Heritage, see www.buildingsofireland.ie
NMS	National Monuments Service. Regulatory body with the DHLGH with responsibility for archaeological heritage.
OS	Ordnance Survey
OSI	Ordnance Survey of Ireland
RMP	Record of Monuments and Places. An update of the older SMR, (sites and monuments record), on which all known archaeological sites are marked and listed in an accompanying list. The sites marked afford legal protection under the National Monuments Acts 1930-2004. The record is based on the 6-inch map series for the country and is recorded on a county basis. Each archaeological monument on the RMP has a unique code known as the RMP number prefixed by LI for Limerick.
RMP Number	This code is the number of the site on the RMP constraint map. It begins with the county code, for example LI for Limerick, the 6-inch sheet number, followed by the number of the archaeological monument on that sheet.
RPS	Record of Protected Structures
S	South
Second Edition	This relates to the OS 25-inch maps for each county. The second edition map completed for the area dates to the early 1900s and this is referred to in the text as the '25-inch map'.
Sheet	This relates to the 6-inch map for each county, which is divided into sheets
SMR	Sites and Monuments Record. The precursor of the RMP, the SMR now commonly relates to the archive paper files of known archaeological monuments maintained by the Archaeological Survey of Ireland (ASI). These files are arranged according to RMP number
W	West
TR	Trench

EXECUTIVE SUMMARY

A programme of archaeological test trenching was undertaken at Ballinrea, Carrigaline, Co. Cork from the 2nd to the 20th October 2023 in accordance with Licence No. 23E0323. These works were undertaken for Ørsted under planning reference 17/06784 by Rubicon Heritage Ltd. The local planning authority is County County Council. The proposed development is centred on ITM coordinates E571300, N565553 (Figures 1–7).

A geophysical survey was undertaken (Gimson 2018), the results of which informed the layout of the trenches. An Archaeological Impact Assessment of the proposed development site was also carried out (Hourihan and Sims 2017) and subsequently updated in 2018 (Hourihan *et. al.* 2018), to include the addition of geophysics, and 2023 (O'Flaherty 2023), due to modifications to the permitted solar layout and a proposed internal network cable route at Ballinreeshig, Kilahone and Ballinvuskig townlands, Co. Cork.

The programme of archaeological testing comprised the excavation of 76 trenches. These trenches were excavated within the footprint of the proposed development to assess the potential for subsurface archaeological remains. The trench layout was arranged to target identified geological features.

Nothing of archaeological significance was identified in Area 1. A total of three burnt mounds, eight primarily isolated pits or possible pits and four isolated deposits, three ditches, two curvilinear ditches and three linear features were uncovered within Area 2. While in Area 3, a total of 16 pits/possible pits, six stake-holes/possible stake-holes and one possible post-hole were recorded. Linear agricultural features such as lazy bed furrows, plough furrows and field boundaries were observed across all areas.

The current policy of the Minister for Culture, Heritage and the Gaeltacht is that preservation *in situ* of archaeological sites is the preferred option. Where possible, every reasonable effort should be made to preserve *in situ* or reduce the impact on any identified archaeological material through design. Further, where preservation in-situ is not the option chosen, there must be preservation by record (i.e. archaeological excavation and recording must take place)[1].

The following recommendations are proposed for this development:

1. Previously agreed buffer zones around significant archaeological features should be adhered to.

2. Where feasible archaeological features and deposits identified during test-trenching works should be preserved *in-situ*.

3. Where preservation *in-situ* cannot be achieved, either in whole or in part, then a programme of full archaeological excavation should be undertaken, to ensure preservation by record of the identified archaeological features/deposits that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under licence and in accordance with the provisions of the National Monuments Acts 1930-2014.

4. A detailed archaeological mitigation strategy should be submitted to, and agreed with, the Local Authority Archaeologist for the development. This should clearly define the

[1] https://www.archaeology.ie/sites/default/files/media/publications/archaeology-planning-process-pl13.pdf

'preservation *in-situ'* and 'preservation by record' strategy for identified archaeological features and deposits.

5. A suitably qualified archaeologist should monitor all topsoil removal within the development. This will be completed under licence from the National Monuments Service (NMS). Ground works shall be carried under the direction of the appointed archaeologist; no removal of topsoil is to take place in the absence of the archaeologist.

6. Should additional archaeological material be uncovered during topsoil removal this should be subject to items 2–4 above.

7. The results of any archaeological test trenching, monitoring, surveys and/or excavation should be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland.

Please note all the recommendations in this report are subject to approval of the County Archaeologist and the National monuments Service, Department of Housing, Local Government and Heritage. As such they are subject to change.

1. INTRODUCTION

1.1 Site location and description

A programme of archaeological test trenching was undertaken at Ballinrea, Carrigaline, Co. Cork from the 2nd to the 20th October 2023 in accordance with Licence No. 23E0323. These works were undertaken for Ørsted Ltd.

The proposed development site is located in the townland of Ballinrea, in the Parish of Carrigaline, in the Barony of Cork, Co. Cork (Fig. 1). The nearest urban settlement is the town of Carrigaline, the centre of which is 2.7 km southeast of the proposed development site. The proposed development covers an area of 47.49 ha (of which 34 ha will be fenced and 13.49 ha will be excluded).

The topography of the area comprises undulating pasture lands at 40-80 m OD. The land is generally level in the northern portion of the site but slopes to the south from the location of a standing stone (RMP CO086-11) and ringfort. The site contains three fields (Fig. 1) bounded to the west by the Ballinrea Road and to the east, north and south by further farmland. There are also several houses to the northwest and southwest of the development site. The lands are enclosed by mature hedgerows and trees.

1.2 Planning Background

An Archaeological, Architectural and Cultural Heritage Impact Assessment was initially undertaken for McCutcheon Halley Planning Consultants by Rubicon Heritage Services Ltd during August 2017 and was revised and updated in September 2018 on foot of a request for Further Information from Cork County Council (Planning Ref: 17/06784).

In December 2017 Cork County Council issued a request for Further Information (FI) in relation to the proposed development (Planning Ref: 17/06784). Point #9 of the FI requested additional advance archaeological investigations including geophysical survey be carried out. After discussions with the Cork County Archaeologist, a geophysical survey (Figs. 6 and 7) was carried out by Earthsound Archaeological Geophysics in May and June 2018 (Gimson 2018; Licence No 18R0045; See Appendix 6).

The Impact Assessment was then updated and revised (Appendix 6), to integrate the findings of the geophysical survey and to present appropriate revised mitigation measures in response to Point #9 of the FI request.

A grant of planning permission was approved by An Bord Pleanála (ABP-303013-18) in 2018 subject to conditions. Condition 8 states:

> *'All works shall be carried out in accordance with the mitigation measures outlined in Section 5 of the revised Archaeological, Architectural and Cultural Heritage Impact Assessment, submitted to the planning authority on the 27th day of September, 2018'.*

The following was extracted from Section 5 mitigation strategy of the revised Archaeological, Architectural and Cultural Heritage Impact Assessment (Hourihan *et. al.* 2018, Fig. 2).

- A buffer zone of at least 20 m has been incorporated in the design around each of the three RMP sites and any features associated with them (as revealed by geophysical survey) that are present on the site. A buffer zone has also been incorporated around the footprint of the possible hillfort or barrow cemetery (CH120) which was revealed by geophysical survey. These

buffers should be physically demarked on the ground for the duration of the construction works.

- 'No-dig' zones have been designed around the relict landscape features revealed by geophysical survey (CH122 and CH123). Only non-invasive above ground solar panel supports to be used within these areas and no other sub-surface works such as cable trenches. Protective matting to be put in place during installation to prevent machine rutting.

- Archaeological test trenching under licence from the DoCHG to be carried out on all other geophysical anomalies identified, and on a sample of the area that was clear of anomalies in order to determine the exact nature of the anomalies and to test the reliability of the geophysics. It is proposed that this test trenching be done prior to construction, rather than prior to the grant of planning permission. The geophysical anomalies that appeared to be definite archaeology (hillfort or barrow cemetery) have been avoided through redesign of the site layout. The other geophysical survey anomalies identified fit into the category of 'areas of unclear archaeological potential' which the NMS guidelines (2016) suggest can be dealt with by way of a condition of a grant of permission.

- A report to be produced on the results of the testing and this Impact Assessment to be updated to take account of the results in order to have a full assessment of the impacts on cultural heritage. This report to be furnished to the local authority archaeologist and the NMS- this will determine what further mitigation may be necessary. If archaeology is identified, it is likely that redesign of the development will be required in order to preserve the archaeology in situ- this may include suitable buffer zones. The 'No-Dig' zones can be expanded to incorporate any features that prove to be of archaeological significance through the test trenching exercise.

- A perimeter hedge should be planted and maintained around the standing stone (CH017). This should be removed when the solar array is decommissioned to restore the current views.

1.3 The proposed development

The proposed development consists of circa 159,100 m2 of solar panels on ground mounted frames, 1 no. substation, 10 no. single storey inverter/transformer stations, battery storage module and associated equipment building, security fencing, satellite pole, CCTV and all associated ancillary development works (Fig. 1). Construction and operational access to the site will be via the existing entrance from the L2464.

2. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

The following information was extracted from the impact assessment for the purposes of this method statement (Hourihan *et. al.* 2018).

2.1 Prehistoric Period

There is abundant evidence for prehistoric settlement in Co. Cork and there are several sites within the study area that may date to this period. These amount to eight *fulachtaí fia* (CH007, CH008, CH011 to CH013, CH015, CH019 and CH021)) and three standing stones (CH010, CH016 and CH017) which may be Bronze Age in date. There is an undated enclosure (CH020) located within the proposed development site that could also be prehistoric in date.

Fulachta fiadh survive as low mounds, usually horse-shoe shaped, of charcoal-enriched soil packed with fragments of heat-shattered stones (termed 'burnt mound'); when levelled, they are often noticeable as black spreads in ploughed fields. They were usually situated close to a water source, like a stream, or in wet marshy areas. It is generally accepted that they were probably used as cooking places (Ó Drisceóil 1988). Water was boiled in a regular pit (lined with wooden planks or stone slabs to form a trough) by the addition of hot stones from a fire close by. O'Kelly (1954, 105–55) showed by experiment that the large quantities of water can be boiled in this way in about twenty minutes. He also demonstrated that meat, wrapped in straw and immersed in the boiling water, cooked at a rate of twenty minutes per pound weight. When the cooking was over the remnants of heat-shattered stones in the trough were discarded to one side. Eventually, after many cookings, these would form a mound curving round three sides of the trough, hence the horse-shape mound (Power *et al.* 1997, 75). It is not certain whether *fulachta fiadh* were elements temporary hunting camps or of permanent settlements. The majority of radiocarbon dates place these monuments in the Bronze Age (Brindley and Lanting 1990, 55–6. They are the most numerous prehistoric sites in Ireland, with over 4,500 known examples, some 2,000 of these in Co. Cork (Power 1990, 13–17).

A review of the use of the term '*fulacht*' in early Irish literature and of references to 'activities that may have taken place at such sites', suggest associations with 'the cooking and eating of food, washing and bathing, music and sex' (Ó Drisceóil 1990, 157– 64). The word '*fulacht*' means a pit used for cooking. The second element can be interpreted as either '*fiadh*' meaning 'of the deer' or 'of the wild' or '*fian*' meaning 'of a roving band of hunters or warriors' or 'of *Fianna* or *Fionn Mac Cumhail*' (Ó Drisceóil 1988, 671–80).

Within the study area, there are eight burnt mounds located to the north-east and south of the proposed development site.

Standing stones are quite common in Cork. The three standing stones within the study area (one of which was located within the proposed development site) are likely to be Bronze Age in date. These stones were used variously as burial, territorial and route way markers. The Bronze Age saw a population explosion in Ireland that led to the development of a social hierarchy and a warrior elite. It was during this period that metalworking was introduced into the country, which appears to have made its way to Irish shores through trading and cultural contacts.

A significant number of standing stones were damaged in antiquity. They may have been seen as pagan symbols of the past by Christians of a later period. Distinguishing prehistoric standing stones from later examples can be difficult, but generally they are between 1m – 3m tall and are unworked where later stones may be roughly shaped or smoothed. They usually have a rectangular or diamond-shaped cross-

section, the long axis of which often aligns NE-SW. Standing stones are another prominent feature of the prehistoric landscape and tend to be sited on hillslopes.

2.2 Medieval period (AD 400–1540)

The early medieval period (AD 400 – *c*. 1169) was a time of rapid expansion of agriculture. Throughout this period Ireland was a predominantly rural society characterised by dispersed settlement. The economy was based on mixed agriculture though the rearing of cattle was seen as very important. Ringforts and enclosures are indicative of settlement at this time.

Ringforts are undoubtedly the most widespread and characteristic archaeological field monument in the Irish countryside. There are six known with the study area (CH001, CH002, CH005, CH006, CH009 and CH018) one of which is located within the proposed development site (CH018). The undated enclosure (CH020) within the site may also be early medieval in date. They are usually known by the names *ráth* or *lios*, forming some of the most common placename elements in the countryside. The ringfort is basically a circular or roughly circular area enclosed by an earthen bank formed of material thrown up from concentric fosse (ditch) on its outside. Generally, the diameter of the enclosure is between 25 m and 50 m. A single bank and fosse (univallate) are the most usual form; double rings (bivallate) or triple rings (trivallate) are rarer. The number of rings of defence are thought to reflect on the status of the site, rather than the strengthening of its defences. These sites have endured centuries of erosion, reuse and sometimes deliberate destruction and it is not always possible to distinguish original features; the overgrown nature of many sites compound the problem of field recording. However, entrances may be detected where a clear break in the bank is in line with an uncut causeway over the fosse. Souterrains are often found in association with ringforts (Power 1992, 131).

Archaeological excavation has shown that the majority of ringforts were enclosed farmsteads, built in the early medieval period. Though not forts in the military sense, the earthworks acted as a defence against natural predators like wolves, as well as human predators. Local warfare and cattle raiding were commonplace at this time. The construction of so many throughout the country, in a relatively short period (400–500 years), reflects on the stability and wealth of society at the time, and also its homogeneity. As well as farming-related activities like corn-grinding and animal husbandry, the ringfort was home to a wide variety of craft industries, including spinning, weaving, metal- and glass-working. A lime-kiln (CH004) was also record in association with ringfort CH002. Dwellings and outhouses were built on timber posts, with walls of wattle, mud or sods, which usually leave no trace above ground today. Excavation can trace the remains of these structures by revealing features like post-holes, stake-holes and sunken hearths. The favoured locations for ringforts are on the shoulder of ridges or at breaks of slopes. Many have level interiors created by scarping-up on the downslope and cutting into the upslope. The enclosing element can change dramatically from a downslope scarped edge to a well-defined bank and fosse on the upslope. Thus sited, they are often overlooked close-in on one side but otherwise command an extensive view (Power 1992, 131). Post-medieval (AD 1540–1700) & early modern period (AD 1700–1850)

A famine graveyard (CH014), known locally as 'The Paupers Graveyard' is located to the northeast of the proposed development site atop Carr's Hill on east side of Carrigaline-Cork road. The land donated by the Carr family during famine to alleviate St. Joesph's cemetery (CO074-102---) and was consecrated 'All Saints Cemetery'. No surface evidence remains for the burials and there is large metal cross at west end.

A detached three-bay two-storey house (CH022), built *c*. 1830 is located to the southeast in the townland of Knockmore.

2.3 Review of Statutory Designations

2.3.1 Record of Monuments and Places (RMPs)

The files of the Record of Monuments and Places (commonly known as the RMP), form part of the archives of the Department of Housing, Local Government and Heritage. These files list all known archaeological sites and monuments in the country and are one of the primary repositories of potential information on the archaeological record.

The monuments and sites identified in the Record of Monuments and Places are registered by Recorded Monument Numbers (Rec. Mon. No.) that are comprised of three elements: (i) a letter or letters indicating county (e.g., CO = Cork); (ii) a three-digit number indicating the relevant Ordnance Survey Sheet no. (e.g., 005); (iii) a three-, four- or five-digit number representing each individual site or monument (e.g., CO004-014).

There are three RMPs located within the proposed development site and 17 other RMPs located within 1 km of it (Fig. 2). These include eight *fulachtaí fia*, six ringforts, three standing stones, an enclosure, a lime kiln and a famine graveyard. The numerous *fulachtaí fia* and standing stones are an indication of prehistoric activity in the general area. It is possible the undated enclosure may also be prehistoric in date. There is strong evidence of medieval settlement nearby, with six ringforts within the study area. There is also evidence of a lime kiln and a post-medieval famine graveyard within the study area. There are three RMPs located within the proposed development site. The first is an enclosure (CH020), located in the northeast corner of the site. The field boundary between respects the curve of the eastern edge of the enclosure, but no visible traces remain at ground level. The second is a ringfort (CH018) located at the western edge of the site near the Ballinrea Road and again no visible traces remain at ground level. The third RMP within the proposed site is a standing stone (CH017) which still survives today.

2.4 Previous Archaeological Excavations

The Excavations Bulletin is an annual account of all excavations carried out under license. The database is available online at www.excavations.ie and includes excavations from 1985 to 2014. This database was consulted as part of the desktop research for this report to establish if any archaeological investigations had been carried out within the study area. The database produced one result for archaeological excavations undertaken within the study area.

County: Cork
Site name: BALLINREA AND BALLINIMLAGH, CARRIGALINE
Sites and Monuments Record No.: CO086–028–031
Licence number: 09E0429
Author: Avril Purcell, Lane Purcell Archaeology, Deanrock Business Park, Togher, Cork.
Site type: *Fulachta fiadh* and possible ringfort
ITM: E 571739m, N 565480m

A total of 58 test-trenches were mechanically excavated across the site on which it is proposed to develop two 18-hole golf-courses and associated facilities. A geophysical survey had been carried out on the available portions of the development site and did not reveal obvious features of archaeological potential. It was significantly compromised by the nature of the underlying geology. The ploughed-out remains of the two *fulachta fiadh* (CO086–029 and CO086–030) were identified during testing as well as three more levelled *fulachta fiadh*. The levelled remains of one of the possible ringforts (CO086–028) were revealed and a number of features of archaeological potential were identified in the vicinity of the other ringfort (CO086–031), however the ringfort itself was not identified. Within a number of the test-

trenches small features of archaeological potential were identified which require further investigation should development proceed.

2.5 Cartographic Analysis

The cartographic record for the study area was examined (Figs. 4 and 5). Both the First Edition 6-inch Ordnance Survey Sheet and the Second Edition 25-inch Ordnance Survey Sheet show changes to the field divisions within the proposed development site. The 6-inch map shows 51 small enclosed fields. The layout of this field system changed significantly after the mid-19th century and many of the older field boundaries were cleared. The 25-inch map depicts just 32 fields. In the present day, there are just three fields within the site boundary.

There is one townland boundary that borders the proposed development site; Ballinrea/Ballinrea South along the southwestern boundary.

Vernacular settlement is noted on the First Edition 6-inch and 25-inch maps within the proposed site boundary. There are 18 structures (CH023–CH037 and CH039–CH041) located within boundary of the development mostly along the western boundary running along the Ballinrea Road with a few others located in where the modern farm buildings now stand toward the centre of the site. There are significant changes to this site in the late 19th century and by the time the 25-inch map is surveyed, only five of these structures remained all of which seem to relate to the evolution of the present-day farm buildings at the centre of the site. None of these buildings are now visible on the ground.

There are a further 11 undesignated cultural heritage sites which may be directly impacted by the proposed grid connection route. An old trackway (CH109), a spa well (CH115) and a structure (CH119), all visible on the first edition 6-inch Ordnance Survey sheet – as well as eight townland boundaries (CH110-114 and CH116-118) that cross the proposed cable route.

2.6 Areas of Archaeological Potential

A geophysical survey of the proposed development site was carried out by Earthsound Archaeological Geophysics in May and June 2018 (Gimson 2018; Licence No 18R0045; See Appendix 6).

Anomaly M24 corresponds to the known enclosure site CH020 (RMP CO086-131) and consists of a double ditched enclosure, measuring 105 m in diameter. A negative signature can be seen in the geophysics data between these ditches which may indicate the presence of bank material. The monument incorporates a portion of the extant field boundary to the east. On the southern edge of M24 a small portion of ditch was detected which appears to follow the alignment of the enclosure ditches. This ditch may be agricultural in origin or possibly suggests the presence of a third outer ditch. To the southwest a possible entranceway was detected. Two further anomalies immediately south of it M22 and M23 both comprise arcs of possible ditches that could be archaeological, agricultural or geological in origin. If these are archaeological features then they could be outlying features relating to the CH020 enclosure site.

No trace of the levelled ringfort site CH018 (RMP CO086-112) was found at the location it is officially recorded. However, approximately 100 m to the east was anomaly M19 that comprises a double ditched enclosure, measuring 56 m in diameter. The edge of the enclosure may have been impacted by the adjacent buildings and associated boundary. Thirteen possible pits were detected within the enclosure. It is most likely that this represents the remains of the levelled ringfort.

Anomaly M16 is an arcing possible ditch, 49m long which could be archaeological or geological in origin. It is located *c*. 20 m to the southwest of the standing stone CH017 (RMP CO086-111) and could reflect a feature associated with this known site.

Anomalies M17 and M18 (designated CH120) extend across an area measuring around 170 m in diameter and are contained by a possible enclosure ditch which incorporates a portion of the extant field boundary and relict field boundaries identifiable on historic mapping and the survey dataset. Contained within this enclosure ditch, a large number curvilinear anomalies—indicative of ring-ditches, enclosure ditches and possible pits—were detected, which indicates extensive habitation remains. It is possible that this enclosure may in fact represent a hillfort or perhaps a barrow cemetery.

Three extensive areas of raised magnetism M1 were identified within the southern field (now designated CH121). These anomalies do not appear to be dipolar in origin indicating that they are likely to be associated with burnt remains or backfilling. The location of all three close to an old water channel (M2) could indicate that they are archaeological in origin, possibly associated with a *fulacht fiadh*. The northern feature within M1 may be enclosed by an arcing ditch and postholes.

A series of relict field boundaries M7 (corresponding to field divisions shown on historic Ordnance Survey mapping) were identified across the site. In addition, there were a number of similar linear anomalies across the site—M4, M8, M9, M12, M13, M14, M25 and M26 (now designated CH122)—which do not correlate to any boundaries shown on historic mapping. However, these are likely to also be relict landscape features relating to fields and agricultural activity prior to 1800.

Anomalies M5 and M6 (now designated CH123) are located at the site of vernacular buildings shown on historic Ordnance Survey mapping (CH039 and CH040) and may relate to this former settlement. Anomalies M10, M11, M15, M20 and M21 (now designated CH124–CH128) all comprise curving or arcing features that may represent curvilinear ditches, which may be archaeological, agricultural or geological in origin.

3. OBJECTIVES AND METHODOLOGY

3.1 Objectives

The objective of the archaeological testing programme is to identify the presence or absence of archaeological remains within the proposed development area and to establish the nature, character, extent and significance of any archaeological features or deposits which will be potentially impacted by the development.

3.2 Methodology

The work scope entailed a programme of archaeological testing. The archaeological works were carried out in accordance with the requirements of the Employer, the Contractor and the conditions associated with an excavation licence. Additionally, the works complied with the following:

- *The National Monuments Acts 1930-2004*.
- *Framework and Principles for the Protection of the Archaeological Heritage*, Department of Arts, Heritage, Gaeltacht and the Islands (DAHGI 1999a).
- *Policy and Guidelines on Archaeological Excavation*, Department of Arts, Heritage, Gaeltacht and the Islands (DAHGI 1999b).
- *Guidelines for Archaeologists*, Institute of Archaeologists of Ireland (2013).

Archaeological test trenching involved the mechanical excavation of 76 trenches, to test the veracity of the preceding geophysical survey (Figure 5). Test trenches were excavated using two tracked 13t and 30t excavators fitted with a 1.80–2.20m wide grading bucket.

The exposed subsoil was examined for archaeological features. When potential archaeologically significant features/deposits were identified mechanical excavation ceased; the features were then cleaned, and exploratory sections dug by hand.

Recording was carried out using the Rubicon Heritage Services Ltd standard method and was undertaken on *pro forma* record sheets. All contexts and trenches have been given unique numbers. Photographic recording was carried out using a 12 MegaPixel Samsung A51, a 12 MegaPixel Olympus Tough TG-6 and a 20 MegaPixel DJI Phantom 4 Pro+ drone.

4. RESULTS

All trenches were given a unique number and a full description is included in Appendix 1. A total of 76 trenches were excavated across the development area (Figures 8–11; Plates 1–12).

All test trenches were excavated under constant archaeological supervision to the level of natural subsoil. The general soil profile encountered in the trenches consisted of topsoil (001, mid-brown clayey silt 0.30–0.50 m deep, while the subsoil ranged from mid-brownish orange gravelly clay in Area 1 to mottled pinkish grey stoney clay in Areas 2 and 3. Plough furrows and lazy bed furrows were frequently observed and were orientated in various directions. They measured on average 0.30–0.50 m wide, 0.10–30 m deep, and generally filled by mid-greyish-brown silt.

4.1 Area 1

Features identified during archaeological testing in Area 1 consisted of linear agricultural features, such as lazy bed furrows, plough furrows and field boundaries (Anomaly M7) as noted in the geophysical survey.

In addition, Anomalies M20 and M21 corresponded to changes in the underlying geology.

Linear agricultural features corresponding to field boundaries (anomaly M7) were identified through geophysical survey and examination of historic maps included C006 and C008 in TR 1.12, C010 in TR 1.8 and 1.10, C012 in TR 1.7 and 1.8, C014 and C016 in TR 1.3 and TR 1.4, C022 and C024 in TR 1.17.

Geophysical anomalies M20, M21, M25 and M26 were not identified during archaeological testing and were determined to be part of the overall intercutting pattern of linear agricultural features.

Linear features C006 and C008 formed part of a NNW–SSE orientated field boundary which was noted in TR 1.11 and in TR 1.12. Both measured 1.20 m wide and were 0.20–0.22 m deep. The fills, C007 and C009, consisted of the same mid-purplish-brown silty clay with frequent stones.

Linear feature C010 was noted in TR. 1.10. It was orientated NE–SW, 0.08 m wide and 0.30 m deep. The fill, C011, was similar to fills C007 and C009–a mid-purplish brown silty clay with frequent stones.

Another field boundary, C012, was identified in TR 1.7 and again in TR 1.8. This was a linear, NNW–SSE orientated ditch which measured 0.80 m wide and was 0.30 m deep. The fill C013 was the same as other fills of similar features–a mid-purplish brown silty clay with frequent stones.

Parallel linear features C014 and C016 were identified in TR 1.3 and again in TR 1.4 and corresponded to anomaly M7 field boundaries (Plate 2). C014 was a linear ditch orientated NW–SE with gradually sloping sides which measured 1.80 m wide and 0.30 m deep. Parallel to C014, C016, had moderate to sharply sloping sides and an almost flat base; it measured 1.10 m wide and was 0.30 m deep. The fills C015 and C017 were the same greyish brown sandy silt with frequent small stones.

Parallel linear features C018 and C020 were noted in the western end of TR. 1.4 and corresponded to anomaly M7 field boundaries. These were NW–SE orientated ditches with moderate to steep sloping sides and almost flat bases. Both measured 1.10 m wide and were 0.30 m deep. The fills C019 and C021 were the same greying brown sandy silt with frequent stones.

Parallel linear features corresponding to field boundaries were also identified in TR 1.17. C022 and C024 were orientated SW–NE and each measured 0.8 m wide and 0.3 m deep. The C023 and C025 were the same greyish-brown sandy silt with frequent stones.

4.2 Area 2

The subsoil in Areas 2 and 3 comprised of mottled pinkish grey stoney clay (C026).

A total of three burnt mounds (C080, C081 and C084), eight primarily isolated pits or possible pits (C043, C049, C051, C053, C055, C062, C070 and C072), four isolated deposits (C078, C079, C085 and C086), parallel field boundaries (C066 and C068), a single-ditch field boundary (057), three ditches (C032, C034, C076), two curvilinear ditches (C027 and C029) and three linear features (C045, C047, C083) were uncovered within Area 2.

4.2.1 Archaeological features

Anomaly M15 corresponded to changes in the underlying geology.

TR 2.4 was moved a short distance to the north-west due to the standing stone (CO086-111) being recorded in the wrong location. In reality it is located at ITM co-ordinates 571046/565425, rather than at the SMR listed location of 571056/565395 (Figure 8).

Anomaly M1 was confirmed to be areas of burning in the form of burnt mounds or *fulacht fiadh* in TR. 2.19, TR. 2.20 and TR. 2.21 (Plate 9). Additional trenches were opened in the vicinity in an attempt to ascertain the extent (TR. 2.35, TR. 2.36 and TR. 2.37, 2.39 and 2.40). The northern-most mound (C080) was sub-circular in plan and measured 21.50 m north–south by 19m east–west and 0.30 m deep. It was composed of dark brown to black clayey silt with moderate amounts of charcoal and abundant small to medium heat-affected stone. The eastern-most mound (C081) was sub-circular in plan and measured 18.65 m north–south by 10.70 m east–west (Plate 10). This mound measured a minimum of 0.50 m deep, although the full depth could not be ascertained due ingress of water into the trench. It comprised of dark brown to black clayey silt with moderate amounts of charcoal and abundant small heat-affected stone. The western-most mound (C084) was irregular in plan and measured 0.40 m north–south by 11 m east–west and was 0.20 m deep. It comprised of dark brown to black clayey silt with moderate amounts of charcoal and abundant small heat-affected stone.

There were four archaeological deposits recorded in Area 2, all small deposits of charcoal rich soil and heat-shattered stone:

Deposit C078 was located in TR. 2.26, isolated from the three main deposits, and measured 1.60 m north–south by 0.80 m east–west. It was 0.08 m deep. This deposit was oval in plan and comprised of charcoal-rich silt and heat-shattered. TR. 2.26A was added to the west for further investigation. This deposit is located in the immediate vicinity of anomaly M6—a rectangular structure on the OSI historic 6-inch map of 1845 (Sheet CK086). Although there was no such structure uncovered, it is likely that this deposit accounts may be associated with this anomaly.

Deposit C079 was situated *c.* 27.50 m to the north-west of deposit C078 in TR. 2.24. It was orientated SE–NW and measured 1.90 m long, 0.35 m wide and 0.15 m deep. It was comprised of charcoal-rich silt and heat-shattered stone. TR. 2.24A was added to the north for further investigation.

Deposit C085 was situated in TR. 2.22. C085 was oval in plan and orientated SE-NW. It measured 0.85 m long by 0.58 m wide. It was of charcoal-rich silt with large heat-shattered stones. TR. 2.22A was added to the north for further investigation.

Deposit C086 was located in TR. 2.23. It was oval in plan and orientated SE-NW. It measured 1.50 m long, 1 m wide and 0.20 m deep. It was of charcoal-rich silt with large heat-shattered stones. TR. 2.23A was added to the north for further investigation.

Pit C042 was situated midway along TR. 2.17. It was circular in plan and measured 1.35 m in diameter and 0.12 m deep (Plate 3). The basal fill (C043) comprised of 80% charcoal with grey silt and was 0.02 m deep. Over this lay C044 and was of mid-purplish-brown silt with heat-affected clay. C044 was 0.10 m deep.

Pit C049 was within TR. 2.15. It was situated along anomaly M14, a series of interconnecting ditches. It was circular in plan and measured 0.50 m in diameter and 0.10 m deep. It was filled by C050–mid-greyish-brown silty clay.

Located in the north-western end of TR. 2.12, was pit C051 (Plate 4). This pit was sub-circular in plan and orientated north–south. Pit C051 measured 0.90 m long, 0.80 m wide and 0.30 m deep. It was filled by C052–dark-brownish-grey silt with occasional small stones.

Mid-way along TR. 2.16, was pit C053. This pit was sub-circular in plan and orientated north–south. It measured 0.47 m long, 0.37 m wide and 0.06 m deep. It was filled by C054–mid-greyish-brown sandy silt with 40% charcoal.

Pit C055 was mid-way along TR. 2.12. This pit was sub-circular in plan and measured 0.65 m long, 0.60 m wide and 0.22 m deep. It was filled by C056, dark greyish-black clayey silt with frequent heat-affected stones and occasional charcoal flecks.

On the northern extents of TR. 2.27, was possible pit C062. Pit C062 was sub-oval in plan and orientated NE-SW. It measured 0.70 m long, 0.50 m wide and 0.20 m deep. This pit was filled by C063 and was composed of brown silty clay with a concentration of charcoal on the northern side.

Pits C070 and C072 were located within TR. 2.31 and were spaced 6.65 m apart. Pit C070, the most westerly of the two was irregular in plan and orientated NW-SE (Plate 5). It measured 1.40 m long, 0.60 m wide and 0.15 m deep. Pit C070 was filled by C071–mottled brown silty clay with frequent slag. Pit C072 was oval in plan and orientated NW-SE. It measured 0.90 m long, 0.35 m wide and was 0.10 m deep. Pit C073 was filled by C072, dark grey clayey silt with occasional charcoal and heat-affected stone.

Curvilinear ditches C027 and C029 (Plate 6) were situated within TR. 2.1, TR. 2.2 And TR. 2.8 (extension). They were orientated SE-NW and spaced 7.80 m apart. Ditch C027 measured 0.70 m wide and 0.80 m deep, while ditch C029 ranged from 0.70 m to 1.80 m and as also 0.80 m deep. The rounded terminus of C027 was observed in TR. 2.8. They were filled by C028 and C030 and were composed of orangish-grey sandy silt. Ditch C032 in TR.1.14 is similar in form to these ditches and is likely associated with C027 and C029. These features did not correspond to any geophysical anomaly or feature on the historic mapping. These ditches appeared different in form than the previous agricultural features observed during the testing and hence are classed as being possible archaeological in nature. Only further archaeological excavation may make their origin clearer.

4.2.2 Agricultural features

Double-ditch field boundaries C066 and C068 were located mid-way within TR. 2.31. They were orientated SE-NW and spaced 6.65 m apart. They measured 1.80–2 m wide and 0.20–0.60 m deep. They were filled by C067 and C069–mottled brownish-grey clayey silt. They corresponded to anomaly M7, field boundaries.

Field boundary C057 was situated in the southern portion of TR. 2.12. This field boundary was orientated NE-SW and corresponded to anomaly M7. It measured 1 m wide and 0.25 m deep. It was filled by C058–greyish brown clayey silt with occasional stone.

Ditch C032 with a SE-NW orientation is situated within TR. 2.2 (Plate 7). It measures 2.50 m wide and 0.90 m deep. It was filled by C033–orangish-grey sandy silt. Ditch C032 does not line-up with any geophysical anomalies.

Ditch C034 (same as C059) which was observed at four locations (TR. 2.7, 2.12 and 2.15) on NE-SW and SE-NW orientations (Plate 8). Ditch C034 measured 1.30 m in with and 0.56 m deep. It was filled by dark brownish-grey sandy silt (C035).

Ditch C076 (Same C066) was within the southern portion of TR. 2.30. This ditch was orientated NE-SW and was 1.30 m wide and 0.55 m deep. It was filled by C077 and of grey stoney silt. This ditch corresponds to anomaly M8.

Situated on the southern end of TR. 2.26, was east–west ditch C082. This ditch measured 1.20 m wide and 0.20 m deep. It was filled by C083 which comprised of mid-grey clayey silt. Three sherds of modern pottery were recovered from this fill (23E0323:83:1–3). This ditch corresponds to anomaly M4, an arcing ditch is also crosses over anomaly M6, structure on the OSI historic mapping of 1845 (Sheet CK086).

Located in the north-western extent of TR2.5, was ditch C038. It was orientated NE–SW and measured 1.20 m wide and 0.15 m deep. It was filled by C039— purplish grey clay.

Situated at the eastern end of TR.2.32, was linear feature C230. This was orientated NE–SW and measured 2 m wide. It was filled by C231—mid-greyish brown silt. This feature lined up with anomaly M9.

Located at the south-eastern end of TR. 2.17 was linear feature C045. This feature was orientated NE-SW and was 1.20 m wide and 0.40 m deep. It was filled by C046 and composed of compact grey stoney clay. Linear feature C047 was situated 16.90 m to the north-east of C045 with a SE-NW orientation. It measured 0.50 m wide and 0.35 m deep. This feature was filled by C048–compact grey stoney clay. It did not continue into TR. 2.18

Linear features C045 and C047 do not appear to line-up with any anomalies.

There was one instances of field clearance C074 within trench 2.27. It was linear in plan and orientated east west. It measured 1.10 m long by 0.40 m wide and was 0.15 m deep. It was filled by a charcoal-rich fill with in-situ burning on the surface.

4.3 Area 3

In Area 3, a total of 16 pits/possible pits (C091, C099, C101, C105, C107, C109, C111, C115, C123, C125, C131, C133, C141, C145, C208 and C210) six stake-holes/possible stake-holes (C116, C119, C121, C127, C129 and C137), one possible post-hole (C139) and parallel field boundary ditches containing levelled burnt mound material (C087 and C089) were recorded. In addition, linear agricultural features such as lazy bed furrows, plough furrows and field boundaries were also observed in Areas 2 and 3.

In addition, Anomalies M8, and M11 corresponded to changes in the underlying geology.

4.3.1 Archaeological features

A small sub-circular pit, C091 was uncovered in TR 3.3, close to the junction with Tr. 3.6. It measured 0.35 m long, 0.28 m wide and 0.13 m deep. The fill C092 was a charcoal-rich silty clay with frequent stone inclusions.

Circular pit C099 was located in TR 3.5; it measured 0.35 m long, 0.30 m wide and 012 m deep. The fill (C100) consisted of a mid-greyish-brown silty clay with charcoal flecks. A second pit, C101, was uncovered in TR 3.22, an expansion of TR 3.5 excavated around C099. C101 was circular in shape and measured 0.35 m diameter and 0.30 m deep. The fill C102 was a mid-greyish-brown silty clay with charcoal flecks.

Several features were identified within the central part of TR 3.8; these are outlined below in Table 1. This included eight pits and five stake-holes

Table 1 features identified within the central part TR 3.8

Context	Trench	Type	Length	Width	Depth	Description	Interpretation
105	3.8	Cut	0.60	0.39	0.12	Oval in plan	Cut of possible pit C106
106	3.8	Fill		0.39	0.12	Mottled dark brownish grey silty clay with charcoal and small stones	Fill of possible pit C105
107	3.8	Cut	0.60	0.50		Sub-circular in plan	Cut of possible pit C108
108	3.8	Fill	0.60	0.50		Dark brown silty clay	Fill of possible pit C107
109	3.8	Cut	1.80	1.30	0.22	Sub-oval in plan	Cut of large pit C110
110	3.8	Fill	1.80	1.30	0.22	Mid-greyish-brown silty	Fill of large pit C109
111	3.8	Cut	0.60	0.30	0.28	Sub-oval in plan	Cut of possible pit C112, truncated by furrow
112	3.8	Fill	0.60	0.30	0.28	Dark greyish-brown silty clay	Fill of possible pit C111
113	3.8	Cut		0.40	0.20	Linear in plan	Cut of furrow C114, truncating C111
114	3.8	Fill		0.40	0.20	Mid-greyish-brown sandy silt	Fill of furrow C113
115	3.8	Cut	0.45	0.30		Sub-oval in plan	Cut of possible pit C0116
116	3.8	Fill	0.45	0.30		Charcoal-rich silty clay	Fill of possible pit C115
117	3.8	Cut	0.10	0.10		Circular in plan	Cut of possible stake-hole C118

118	3.8	Fill	0.10	0.10		Charcoal-rich silty clay	Fill of possible stake-hole C117
119	3.8	Cut	0.12	0.12		Circular in plan	Cut of possible stake-hole C120
120	3.8	Fill	0.12	0.12		Charcoal-rich silty clay	Fill of possible stake-hole C119,
121	3.8	Cut	0.27	0.15		Irregular in plan	Cut of possible stake-hole C122
122	3.8	Fill	0.27	0.15		Charcoal-rich silty clay	Fill of possible stake-hole C121
123	3.8	Cut	0.66	0.50		Sub-circular in plan	Cut of possible pit C124
124	3.8	Fill	0.66	0.50		Mid-greyish-brown sandy silt	Fill of possible pit C123
125	3.8	Cut	0.67	0.56		Sub-circular in plan	Cut of possible pit C126
126	3.8	Fill	0.67	0.56	0.17	Dark greyish-brown silty clay	Fill of possible pit C125
127	3.8	Cut	0.15	0.15		Circular in plan	Cut of stake-hole C128
128	3.8	Fill	0.15	0.15		Mid-greyish-brown silt, frequent charcoal on surface	Fill of stake-hole C127
129	3.8	Cut	0.20	0.05		Irregular in plan, orientated SE-NW	Cut of stake-hole C130
130	3.8	Fill	0.20	0.05		Mid-greyish-brown silt, frequent charcoal on surface	Fill of stake-hole C129
131	3.8	Cut	0.26	0.24		Circular in plan	Cut of pit C132
132	3.8	Fill	0.26	0.24		Mid greyish-brown silt with frequent charcoal on surface	Fill of pit C131

An irregular shaped possible pit (C133) was located in the eastern end of TR 3.10; it measured 1.40 m long, 0.50 m wide and was filled by C134 a dark brownish grey silt with charcoal flecks. C133 was truncated by a furrow C135.

A possible stake-hole, C137 was situated to the west of C133 within TR 3.10; this was sub-circular and measured 0.17 m long and 0.12 m wide. The fill C138 was a light greyish brown sandy silt.

Possible post-hole, C139 was subcircular in shape and measured 0.3 m long and 0.23 m wide. It was filled by C140 a dark brownish grey silt with charcoal flecks.

Another possible pit, C141 within TR 3.10, was irregular in shape and measured 0.80 m long, 0.70 m wide and was 0.23 m deep. The fill C142 was a mottled dark greyish-brown silty clay.

A pit, C145, was located within TR 3.12, to the west of TR. 3.3. This was subcircular in shape and measured 0.40 m long, 0.40 m wide and 0.20 m deep. The fill, C146, was a dark greyish-brown silty clay with heat-affected stone inclusions.

Two features were identified within TR 3.13, C208 and C210. C208 was a circular pit which measured 0.40 m diameter and was 0.20+ m deep. The fill C209 was a mid-brownish grey sandy clay with frequent charcoal flecks. C210 was a possible pit, sub-circular in shape and measured 0.40 m long, 0.30 m wide and 0.15 m deep. The fill, C211, was a dark greyish brown silty clay.

4.3.2 Agricultural features

Parallel linear ditches C087 and C089 were identified in TR 3.1 (Plate 12) and corresponded to anomaly M7. These were SE–NW orientated linear features, 2–2.40 m wide and 0.30 m deep. The fills C088 and C090 were the same and consisted of a charcoal-rich silty clay with frequent heat affected stones indicating a disturbed or levelled burnt mound in the vicinity.

Linear ditch features C093 and C095 were located in TR 3.6 and TR 3.3. These parallel features were orientated N–S and measured 1.50 m wide and 0.30 m deep. The fills C094 and C096 were the same mid-greyish-brown silty clay.

Linear feature C103 was situated in TR.3.6 and orientated NE-SW. It may be a continuation of 097 which matches up with anomaly M13, however recorded as much narrower at a width of 0.60 m. It was filled by C104—brownish grey silty clay.Ditch C097, located in the western end of TR 3.4 and continuing into TR 3.5, corresponded to geophysical anomaly M13. This was NW–SE orientated and measured 2.50 m wide and 0.40 m deep. The fill C098 was a mid-greyish-brown silt.

Linear feature C143 in TR 3.10 corresponded to geophysical anomaly M12; this was orientated east–west and measured 0.65 m wide and 0.25 m deep. The fill C144 was a mottled dark brownish-grey silty clay with frequent stones and charcoal flecks.

Parallel ditch features C147 and C149 corresponded to a roughly E–W orientated field boundary highlighted on the geophysical survey (M7). These measured 0.80 m wide and fills C148 and C150 consisted of the same mid-greyish-brown silt.

Several linear features were identified in TR 3.17 and TR 3.18 which corresponded with anomalies M9 and M10. All were shown to be lazy bed furrows or field boundaries. C157 was NE–SW orientated, 1.50 m wide and 0.40 m deep; the fill was C158 a greyish-brown clay silt. C159 was orientated NNW–SSE and was 0.80 m wide; the fill C160 was a mid-grey silty clay. Three adjacent and almost parallel features C161, C163 and C165 all measured 1.30 m wide and were 0.30–0.40 m deep. The fills—C162, C164 and C166—were mid- to dark-greyish-brown silty clay.

A pair of parallel ditches C200 and C202 in TR 3.16, TR 3.15 and TR 3.14 and continuing into TR 3.13 as C212 and C214 were found to correspond to the N–S branch of the geophysical anomaly M9. These linear features were NE–SW orientated and measured 1.20–1.03 m wide and 0.30–0.40 m deep. The fills—C203, C205, C213 and C214—were very similar greyish-brown or brownish-grey silty clays. A pair of parallel ditches—C220 and C222—were identified in the western end of TR 3.14, also corresponding to anomaly M9. These were NNE–SSW orientated and measured 1.50 m wide and were filled by C221 and C223 which consisted of brownish-grey silty clay.

Parallel features C204 and C206 in TR 3.13 and C216 and C218 in TR 3.14 were found to correspond to geophysical anomaly M12 in the south-eastern part of Area 3. These were roughly N–S orientated

parallel ditches measuring 1.20–2 m wide and 0.20– 0.03 m deep. The fills C205, C207, C217 and C219 were all similar brown-grey or grey-brown silty clays.

Two linear features interpreted as furrows were recorded—C151 and C153. These were situated in the southern end of TR.3.3 and oriented NE-SW. These line up with cultivation furrows on the geophysical survey. They were between 0.90 and 1.30 m wide and likely represented a series of intercutting furrows. They were filled by (C152 and C154) mid grey silty clay.

5. DISCUSSION

Several features archaeological significance was uncovered during the course of archaeological test-trenching at the proposed development site.

Nothing of archaeological significance was identified in Area 1.

In Area 2 a total of three burnt mounds (C080, C081 and C084), eight primarily isolated pits or possible pits (C043, C049, C051, C053, C055, C062, C070 and C072), four isolated deposits (C078, C079, C085 and C086), and two possibly archaeological curvilinear ditches (C027 and C029) were identified.

In Area 3, a total of 16 pits/possible pits (C091, C099, C101, C105, C107, C109, C111, C115, C123, C125, C131, C133, C141, C145, C208 and C210) six stake-holes/possible stake-holes (C116, C119, C121, C127, C129 and C137), one possible post-hole (C139) and parallel field boundary ditches containing levelled burnt mound material (C087 and C089) were recorded.

Linear agricultural features such as lazy bed furrows, plough furrows and field boundaries were observed across all areas.

Geophysical anomalies identified in the survey, which had been interpreted as being possibly archaeological or due to modern agricultural disturbance (Dowling 2023), were partially confirmed to be of archaeological significance, although many were confirmed to be agricultural in nature and are visible on historic maps. The rapidly changing nature of the underlying geological deposits, occurring primarily in bands within the subsoil may have been picked up as geophysical anomalies during the survey–M15, M11, M20, M21 and M25. The proposed development site appears to have been in use for agricultural purposes throughout the 19th and 20th centuries and this may have removed any additional archaeological material which may have been present at the site.

6. RECOMMENDATIONS

The archaeological test excavations at the proposed development at Ballinrea, Carrigaline, Co. Cork revealed previously unidentified features and deposits of archaeological significance. The site has been subject to geophysical survey (Gimson 2018) and a desk-based assessment (Hourihan and Sims 2017).

The current policy of the Minister for Culture, Heritage and the Gaeltacht is that preservation *in situ* of archaeological sites is the preferred option. Where possible, every reasonable effort should be made to preserve *in situ* or reduce the impact on any identified archaeological material through design. Further, where preservation in-situ is not the option chosen, there must be preservation by record (i.e. archaeological excavation and recording must take place)[2].

The following recommendations are proposed for this development:

1. Previously agreed buffer zones around significant archaeological features should be adhered to.

2. Where feasible archaeological features and deposits identified during test-trenching works should be preserved *in-situ*.

3. Where preservation *in-situ* cannot be achieved, either in whole or in part, then a programme of full archaeological excavation should be undertaken, to ensure preservation by record of the identified archaeological features/deposits that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under licence and in accordance with the provisions of the National Monuments Acts 1930-2014.

4. A detailed archaeological mitigation strategy should be submitted to, and agreed with, the Local Authority Archaeologist for the development. This should clearly define the 'preservation *in-situ*' and 'preservation by record' strategy for identified archaeological features and deposits.

5. A suitably qualified archaeologist should monitor all topsoil removal within the development. This will be completed under licence from the National Monuments Service (NMS). Ground works shall be carried under the direction of the appointed archaeologist; no removal of topsoil is to take place in the absence of the archaeologist.

6. Should additional archaeological material be uncovered during topsoil removal this should be subject to items 2–4 above.

7. The results of any archaeological test trenching, monitoring, surveys and/or excavation should be submitted in a report to the Local Authority, the Heritage and Planning Division, Department of Housing, Local Government and Heritage and the National Museum of Ireland.

Please note all the recommendations in this report are subject to approval of the County Archaeologist and the National monuments Service, Department of Housing, Local Government and Heritage. As such they are subject to change.

[2] https://www.archaeology.ie/sites/default/files/media/publications/archaeology-planning-process-pl13.pdf

7. ARCHIVE QUANTITIES

The site archive is comprised of the following materials:

Table 2 Site archive

Item	Quantity
Photographs	375
Registers	4
Field and trench sheets	35
Context Sheets	0

The archive material is contained within one box.

Storage of the archive in a suitable format and location is required in order to provide for any future archaeological research. It is proposed that in addition to the paper archive a digital copy is prepared. The archive is currently stored in the offices of Rubicon Heritage Services Ltd, Unit 2, Europa Enterprise Park, Midleton, Co. Cork P25 TV25. It is proposed that following completion of post-excavation the archive will be deposited with the National Monuments Service, Department of the Arts, Heritage and the Gaeltacht and the National Museum of Ireland.

8. REFERENCES

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Electronic Resources

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APPENDIX 1 TRENCH REGISTER

Area	Trench No.	Depth (m)	Orientation	Description	Notes
1	1.1	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C224. Furrows/lazy beds observed in various directions. Bands of gravel intermittently
1	1.2	0.30	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C224 not seen continuing into trench. Furrows/lazy beds observed running perpendicular
1	1.3	0.40	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C014 and C016. Continues into trench 4 and 5. Furrows/lazy beds observed in various directions
1	1.4	0.40	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C014, C016, C018 and C020. M20–alluvial deposit. Furrows/lazy beds observed running diagonally
1	1.5	0.35	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C014 and C016. Furrows/lazy beds observed in various directions
1	1.6	0.30	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Furrows/lazy beds observed in various directions
1	1.7	0.30	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C012. Furrows/lazy beds observed in various directions
1	1.8	0.35	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C012. Linear feature C010. Furrows/lazy beds observed in various directions
1	1.9	0.40	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M25–concentration of decayed stone C003. M26– field boundary C004. Furrows/lazy beds observed in various directions
1	1.10	0.30	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M25–alluvial deposit. Furrows/lazy beds observed in various directions
1	1.11	0.30	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C006 and C008. Furrows/lazy beds observed in various directions
1	1.12	0.35	NE-SW	Topsoil: Mid-brown clayey silt	Continuation of anomaly M7–field boundary C006 and C008.

Area	Trench No.	Depth (m)	Orientation	Description	Notes
				Subsoil: Mottled purple/orange sandy silt	Furrows/lazy beds observed in various directions
1	1.13	0.30	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Furrows/lazy beds observed in various directions
1	1.14	0.35	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C022 and C024. Furrows/lazy beds observed in various directions
1	1.15	0.40	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M21–alluvial deposit. Furrows/lazy beds observed in various directions
1	1.16	0.50	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Furrows/lazy beds observed in various directions
2	2.1	0.40	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled purple/orange sandy silt	Anomaly M7–field boundary C022. Curvilinear ditches C27 and C29. Possible pit C024. Furrows/lazy beds observed in various directions
2	2.2	0.35	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Ditch C032. Furrows/lazy beds observed in various directions
2	2.3	1	NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundary not seen. C031–natural band in soil. Furrows/lazy beds observed in various directions
2	2.4		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundary C038. Furrows/lazy beds observed in various directions
2	2.5		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundary not seen. Furrows/lazy beds observed in various directions
2	2.6		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Furrows/lazy beds observed in various directions
2	2.7		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M15–alluvial deposits. M14–ditch C034. Furrows/lazy beds observed in various directions
2	2.8		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of E-W anomaly M7 C27 and C29. Furrows/lazy beds observed in various directions

Area	Trench No.	Depth (m)	Orientation	Description	Notes
2	2.9		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of M14–ditch C034. Furrows/lazy beds observed in various directions
2	2.10		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Furrows/lazy beds observed in various directions
2	2.11		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7 not observed. Continuation of Anomaly M14 C034. Furrows/lazy beds observed in various directions
2	2.12		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of Anomaly M14 C061, same as 034. Pits C051 and C055. Furrows/lazy beds observed in various directions
2	2.13		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Furrows/lazy beds observed in various directions
2	2.14		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of Anomaly M14 C061, same as 034. Furrows/lazy beds observed in various directions
2	2.15		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of Anomaly M14 C061, same as 034. Furrows/lazy beds observed in various directions
2	2.16		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Pit C053 and anomaly M7 C057
2	2.17		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M13–ditch C047. Pits C042 and C050. Linear. Linear feature C047. Furrows/lazy beds observed in various directions
2	2.18		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Ditch 040. Furrows/lazy beds observed in various directions
2	2.19		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M1–burnt mound C081 and C084. Spring nearby, trenches increasingly wet moving south
2	2.20		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M1–burnt mound C084, extends to trench 2.19. Spring nearby, trenches increasingly wet moving south
2	2.21		SE–NW	Topsoil: Mid-brown clayey silt	

Area	Trench No.	Depth (m)	Orientation	Description	Notes
				Subsoil: Mottled pinkish grey stoney clay	Anomaly M1–burnt mound C080. Spring nearby, trenches increasingly wet moving south
2	2.22		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	C085 charcoal-rich spread with heat-affected stone. Spring nearby, trenches increasingly wet moving south
2	2.23		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	C086 spread. Spring nearby, trenches increasingly wet moving south
2	2.24		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	C079 deposit. Spring nearby, trenches increasingly wet moving south
2	2.25		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Furrows/lazy beds observed in various directions
2	2.26		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M6–linear feature C082. Furrows/lazy beds observed in various directions
2	2.27		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of anomaly M6–linear feature C082. Possible pit C062. Furrow or field boundary C065. Furrows/lazy beds observed in various directions
2	2.28		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Rock seen in this area. M6–continuation of linear feature C76. Furrows/lazy beds observed in various directions
2	2.29		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Furrows/lazy beds observed in various directions
2	2.30		NE-SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M6–continuation of linear feature C76. Furrows/lazy beds observed in various directions
2	2.31		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Pits C070 and C072, possible anomaly M8. Furrows/lazy beds observed in various directions
2	2.32		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundaries C066 and C068. Furrows/lazy beds observed in various directions
2	2.33		SE–NW	Topsoil: Mid-brown clayey silt	Furrows/lazy beds observed in various directions

Area	Trench No.	Depth (m)	Orientation	Description	Notes
				Subsoil: Mottled pinkish grey stoney clay	
2	2.34		SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Furrows/lazy beds observed in various directions
2	2.35	0.30	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Additional trench across trench 2.21. Anomaly M1–burnt mound C080
2	2.36	0.30	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Additional trench across trench 2.19. Anomaly M1–burnt mound C081 and C084
2	2.37	0.30	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Additional trench across trench 2.21. Anomaly M1–burnt mound C080
3	3.1	0.30	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundary with levelled burnt mound material–087 and C089. Furrows orientated SE-NW
3	3.2	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Nothing of archaeological significance
3	3.3	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M11–alluvial deposits. M7–field boundaries C093 and C095. Pit C091. Furrows/lazy beds observed in various directions
3	3.4	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M13–ditch C097. Furrows/lazy beds observed in various directions
3	3.5	0.35	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7 or M15 not observed. Pit C099. Furrows/lazy beds observed in various directions
3	3.6	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundaries C093 and C095. M13–Linear feature C103. Furrows/lazy beds observed in various directions
3	3.7	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Pits/possible pits C105, C107, C109, C111, C115, C123, C125, C131, furrow C113, stake-holes C117, C119, C121, C127, C129. Furrows/lazy beds observed in various directions
3	3.8	0.40	NE–SW	Topsoil: Mid-brown clayey silt	Anomaly M12 not seen. Pits/possible pits C133, C141,

Area	Trench No.	Depth (m)	Orientation	Description	Notes
				Subsoil: Mottled pinkish grey stoney clay	linear features C135, C143, stake-hole C137, possible post-hole C139. Furrows/lazy beds observed in various directions
3	3.9	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M12 not seen. Furrows/lazy beds observed in various directions
3	3.10	0.35	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M12 not seen. Pit C145. Furrows/lazy beds observed in various directions
3	3.11	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M12 not seen. Furrows/lazy beds observed in various directions
3	3.12	0.35	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M12 not seen. Furrows/lazy beds observed in various directions
3	3.13	0.30	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M11–alluvial deposit. Linear features C204, C206, C212, C214, pits C208, C210. Furrows/lazy beds observed in various directions
3	3.14	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay Subsoil: Mottled pinkish grey stoney clay	Anomaly M7–field boundary C224. M8–agricultural linear features C200, 202, C220, C222. M12–218agricultural linear features C216, C218. Furrows/lazy beds observed in various directions
3	3.15	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M9–C200 and C202. Furrows/lazy beds observed in various directions
3	3.16	0.35	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Anomaly M10–agricultural features C200, C202, C155, C157, C159, C161, C163, C165. Furrows/lazy beds observed in various directions
3	3.17	0.30	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of Anomaly M10–agricultural features C200, C202, C155, C157, C159, C161, C163, C165. Furrows/lazy beds observed in various directions
3	3.18	0.35	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Continuation of Anomaly M10–agricultural features C200, C202, C155, C157, C159, C161, C163, C165. Furrows/lazy beds observed in various directions

Area	Trench No.	Depth (m)	Orientation	Description	Notes
3	3.19	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.20	0.40	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
2	3.21	0.35	NE–SW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.22	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension of trench 3.5. Pit C101.
3	3.23	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.24	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.25	0.35	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.26	0.35	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.27	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension
3	3.28	0.40	SE–NW	Topsoil: Mid-brown clayey silt Subsoil: Mottled pinkish grey stoney clay	Trench extension

APPENDIX 2 PHOTO REGISTER

Photo No.	Area	Camera No.	Direction Facing	Description
3307	1	21	NNW	Pre-excavation, Area 1
3308	1	21	SSE	Pre-excavation, Area 1
3309	1	21	NNW	TR 1.1
3310	1	21	SSE	TR 1.1 gravel area
3311	1	21	SSE	TR 1.1 furrow in SW end trench
3312	1	21	SSE	TR 1.1 furrow in SW end trench
3313	1	21	SSE	Fencing and signage M22 and M23 and digging away from buffer zone
3314	1	21	SSE	Fencing and signage M22 and M23 and digging away from buffer zone
3315	1	21	NE	Post-excavation, TR. 1.16
3316	1	21	NW	Post-excavation, TR. 1.14
3317	1	21	NW	View of lazy beds orientated E-W, TR. 1.16
3318	1	21	SW	Post-excavation, TR. 1.13
3319	1	21	SSW	Mid-excavation of C022 and C024, TR. 1.14
3320	1	21	SSW	Slot in C022, TR. 1.14
3321	1	21	SSW	Slot in C024, TR. 1.14
3322	1	21	S	Section in geophysical anomaly, TR. 1.15
3323	1	21	NE	Section in geophysical anomaly, TR. 1.15
3324	1	21	SE	Second section in geophysical anomaly, TR. 1.16
3325	1	21	NE	Second section in geophysical anomaly, TR. 1.16
3326	1	21	SW	Second section in geophysical anomaly, TR. 1.16
3327	1	21	NE	General shot, TR. 1.15
3328	1	21	ENE	Geological features, west end, TR. 1.15
3329	1	21		VOID
3330	1	21	NE	Post-excavation, TR. 2.7
3331	1	21	NE	Anomaly M15 bands of while clay with furrows
1	1	22	ENE	Pre-excavation, area of TR. 1.9 and 1.11
2	1	22	WSW	Mid-excavation of east end, TR. 1.11
3	1	22	ENE	Post-excavation, TR. 1.11
4	1	22	WSW	West end, TR. 1.9
5	1	22	WSW	West end, TR. 1.9
6	1	22	S	C003, TR. 1.9
7	1	22	NW	C003, TR. 1.9
8	1	22	NE	C003, TR. 1.9
9	1	22	SW	Linear feature C004, C005, TR. 1.9
10	1	22	SW	Section through C004, C005, TR. 1.9
11	1	22	N	Section through C004, C005, TR. 1.9
12	1	22	NW	NW end, TR. 1.10
13	1	22	NE	Parallel furrows, TR. 1.10
14	1	22	E	Parallel ditches C006, C008, TR. 1.11
15	1	22	S	Section in C006
16	1	22	E	Section in C006
17	1	22	S	Section in C008

Photo No.	Area	Camera No.	Direction Facing	Description
18	1	22	W	Section in C008
19	1	22	E	Continuation of C006, C008, TR. 1.12
20	1	22	W	General shot, TR. 1.12
21	1	22	E	Clay/alluvial deposit, non-archaeological, TR. 1.12
22	1	22	W	Clay/alluvial deposit, non-archaeological, TR. 1.12
23	1	22	SW	General shot, TR. 1.8
24	1	22	SW	C010, TR. 1.8
25	1	22	S	Section in C010, TR. 1.8
26	1	22	W	Section in C010, TR. 1.8
27	1	22	NE	Section in C012, TR. 1.7
28	1	22	SE	Section in C012, TR. 1.7
29	1	22	SE	Section in furrow, TR. 1.10
30	1	22	E	Section in furrow, TR. 1.10
31	1	22	SW	General shot, TR. 1.7
32	1	22	NW	Section in furrow, TR. 1.10
33	1	22	SW	Section in furrow, TR. 1.10
34	1	22	N	General shot, TR. 1.10
35	1	22	NW	Alluvial deposits, TR. 1.10
36	1	22	NE	General shot, TR. 1.6
37	1	22	NE	General shot, TR. 1.5
38	1	22	NW	Section in field boundary C014, TR. 1.4
39	1	22	E	Section in field boundary C014, TR. 1.4
40	1	22	SW	Section in field boundary C014, TR. 1.4
41	1	22	E	General shot, TR. 1.4
42	1	22	W	Section in furrow, TR. 1.4
43	1	22	S	Section in furrow, TR. 1.4
44	1	22	W	Section in furrow, TR. 1.4
45	1	22	S	Section in furrow, TR. 1.4
46	1	22	NNW	Field boundary C014, TR. 1.3
47	1	22	ENE	Field boundary C014, TR. 1.3
48	1	22	ENE	Looking over furrow, TR. 1.3
49	1	22	ENE	Looking over furrow, TR. 1.3
50	1	22	E	General shot, TR. 1.3
51	1	22	NNW	General shot, TR. 1.2
52	1	22	NNW	General shot, centre trench, TR. 1.10
53	1	22	NNW	General shot, centre trench, TR. 1.10
54	1	22	NW	Slot in C016, TR. 1.4
55	1	22	NW	Slot in C016, TR. 1.4
56	1	22	E	Field boundary C014, C016, TR. 1.4
57	1	22	W	Field boundary C018, C020, TR. 1.4
58	1	22	S	Section in C018, TR. 1.4
59	2	22	WNW	Section in field boundary C022, TR. 2.4
60	2	22	NE	Section in field boundary C022, TR. 2.4

Photo No.	Area	Camera No.	Direction Facing	Description
61	2	22	SSW	General shot, TR. 2.1
62	2	22	SSW	TR. 1 looking across TR. 2.1
63	2	22	NE	Possible pit C024, TR. 2.1
64	2	22	N	Section in C024, C025, TR. 2.1
65	2	22	W	Section in C024, C025, TR. 2.1
66	2	22	NNE	Post-excavation, TR. 2.3
67	2	22	NNW	Post-excavation, TR. 2.3 with natural band in subsoil
68	2	22	NNE	Post-excavation, TR. 2.3 with natural band in subsoil
69	2	22	NNW	Shot of furrows, TR. 3.3
70	2	22	SSE	Shot of C031
71	2	22	SSE	Slot in C031
72	2	22	N	Section in C032. TR. 2.2
73	2	22	N	Section in C032. TR. 2.2
74	2	22	W	Section in C032. TR. 2.2
75	2	22	E	Section in C032. TR. 2.2
76	2	22	S	Slot in C034, TR. 2.7
77	2	22	S	Slot in C034, TR. 2.7
78	2	22	NNW	Slot in ditch C029, TR. 2.2
79	2	22	SW	Slot in ditch C029, TR. 2.2
80	2	22	SSW	Slot in ditch C027, TR. 2.2
81	2	22	NNW	Slot in ditch C027, TR. 2.2
82	2	22	SW	Ditch C027 continuing, TR. 2.8
83	2	22	SW	Ditch C027 continuing, TR. 2.8
84	2	22	NNW	Ditch C027 continuing, TR. 2.8
85	2	22	NNW	Ditch C027 continuing, TR. 2.8
86	2	22	NNW	Terminus of ditch C027, TR. 2.8
87	2	22	NNW	Terminus of ditch C027, TR. 2.8
88	2	22	W	Post-excavation, TR. 2.7
89	2	22	W	Post-excavation, TR. 2.7
90	2	22	W	Field boundary C038, TR. 2.4
91	2	22	S	Field boundary C038, TR. 2.4
92	2	22	NE	Post-excavation, TR. 2.5
93	2	22	NE	Post-excavation, TR. 2.5
94	2	22	NE	Post-excavation, TR. 2.4
95	2	22	S	Field boundary C038, TR. 2.4
96	2	22	SW	Section in field boundary C038, TR. 2.4
97	2	22	NE	Post-excavation TR. 2.5b
98	2	22	NE	Post-excavation TR. 2.5b
99	2	22	N	Section in ditch C040
100	2	22	W	Section in ditch C040
101	2	22	E	Pre-excavation of pit C041
102	2	22	E	Mid-excavation of pit C041
103	2	22	N	Post-excavation TR. 2.17

Photo No.	Area	Camera No.	Direction Facing	Description
104	2	22		VOID
105	2	22		VOID
106	2	22		VOID
107	2	22		VOID
108	2	22	NW	Pre-excavation of pit C050, TR. 2.15
109	2	22	SW	General shot in TR. 2.15, anomaly M14 visible
110	2	22	N	Slot in anomaly M14, TR. 2.15
111	2	22	NE	Post-excavation, TR. 2.9
112	2	22	N	Post-excavation, TR. 2.10
113	2	22	SSW	Pit C051, TR. 2.12
114	2	22	E	Pit C051, TR. 2.12
115	2	22	NNW	Field boundary, TR. 2.11
116	2	22	S	Post-excavation, TR. 2.11
117	2	22	SE	Mid-excavation of pit C053
118	2	22	E	Post-excavation, TR. 2.11
119	2	22	E	Post-excavation, TR. 2.11
120	2	22	S	View of pit C055, TR. 2.12
121	2	22	W	View of pit C055, TR. 2.12
122	2	22	W	View of pit C055, TR. 2.12
123	2	22	E	Shot of field boundary C057, TR. 2.12
124	2	22	E	Shot of field boundary C057, TR. 2.12
125	2	22	NW	Shot of south end, TR. 2.12
126	2	22	NW	Shot of south end, TR. 2.12
127	2	22	E	General shot, TR. 2.14
128	2	22	NE	Shot of anomaly M14 crossing TR. 2.14
129	2	22	SSW	Shot of slot in anomaly M14 crossing TR. 2.14
130	2	22	SSW	Shot of slot in anomaly M14 crossing TR. 2.14
131	2	22	SSW	Shot of slot in anomaly M14 crossing TR. 2.14
132	2	22	ESE	General shot, TR. 2.33
133	2	22	NW	Shot of possible pit C062, TR. 2.27
134	2	22	NW	Shot of possible pit C062, TR. 2.27
135	2	22	WSW	Section in possible field boundary C064 in east end of TR. 2.27
136	2	22	WSW	Section in possible field boundary C064 in east end of TR. 2.27
137	2	22	NNW	Location shot of possible field boundary C064 in east end of TR. 2.27
138	2	22	E	General shot, TR. 2.32
139	2	22	N	Section in field boundary C066/anomaly M7, TR. 2.32
140	2	22	N	Section in field boundary C066/anomaly M7, TR. 2.32
141	2	22	S	Post-excavation, TR. 2.27
142	2	22	E	Field boundary C068/anomaly M7
143	2	22	E	Field boundary C068/anomaly M7

Photo No.	Area	Camera No.	Direction Facing	Description
144	2	22	N	Field boundary C068/anomaly M7
145	2	22	NW	View of pit C070, TR. 2.31
146	2	22	NW	View of pit C070, TR. 2.31
147	2	22	W	View of pit C070, TR. 2.31
148	2	22	NW	View of pit C072, TR. 2.31
149	2	22	NW	View of pit C072, TR. 2.31
150	2	22	W	View of pit C072, TR. 2.31
151	2	22	N	Shot of heat-affected soil, possibly anomaly M7, TR. 2.31
152	2	22	NNW	View of pit C072 and heat-affected soil, possibly anomaly M7, TR. 2.31
153	2	22	E	C074, TR. 2.27
154	2	22	E	C074, TR. 2.27
155	2	22	SSW	TR. 2.27 from junction with TR. 2.31
156	2	22	SW	Section in linear feature C076, TR. 2.30
157	2	22	NE	Location shot along TR. 2.30
158	2	22	S	General shot, TR. 2.29
159	2	22	S	General shot, TR. 2.29
160	2	22	S	South end of TR. 2.27
161	2	22	E	General shot, TR. 2.28
162	2	22	NW	Deposit C078, TR. 2.26
163	2	22	S	Location shot of C078 in south end of TR. 2.26
164	2	22	NW	Shot of charcoal-rich feature C079, TR. 2.24
165	2	22	NW	Shot of charcoal-rich feature C079, TR. 2.24
166	2	22	W	Shot of location of anomaly, west of C079
167	2	22	NW	Trench extension west of C079, TR. 2.24
168	2	22	NW	Trench extension NW of C079, TR. 2.25
169	2	22	W	Trench extension west of C078
170	2	22	S	C082/anomaly M6, TR. 2.26
171	2	22	W	C082/anomaly M6, TR. 2.26
172	2	22	SSW	TR. 2.21 from north end
173	2	22	SE	TR. 2.35 from west end
174	2	22	SE	TR. 2.37 from west end
175	2	22	NNE	Looking across burnt mound C080 in north end of TR. 2.21
176	2	22	SE	Looking across burnt mound C081 in east end of TR. 2.19
177	2	22	SE	Looking across burnt mound C081 in east end of TR. 2.19
178	2	22	W	TR. 2.19 from TR. 2.21
179	2	22	ENE	Burnt mound material C084, TR. 2.19
180	2	22	ESE	TR. 2.19 from west end with agricultural linear feature
181	2	22	SSE	TR. 2.36 from north end
182	2	22	SSE	TR. 2.36 from north end

Photo No.	Area	Camera No.	Direction Facing	Description
183	2	22	SSE	Burnt mound material C081, TR. 2.36
184	2	22	SSE	Burnt mound material C081, TR. 2.36
185	2	22	W	TR. 2.20 from TR. 2.21
186	2	22	W	Looking across burnt mound material C084 in TR. 2.20
187	2	22	ESE	Irregular agricultural linear seen on geophysics, TR. 2.20
188	2	22	W	Irregular agricultural linear seen on geophysics, TR. 2.20
189	2	22	W	Post-excavation, TR. 2.25
190	2	22	W	TR. 2.25 with investigation of furrow
191	2	22	S	TR. 2.34 from north end
192	2	22	S	Test pit in TR. 2.38, west of TR. 2.34
193	2	22	S	C086 in TR. 2.23
194	2	22	S	C086 in TR. 2.23
195	2	22	W	General shot of TR. 2.23
196	2	22	SSE	South end of TR. 2.21
197	2	22	SSE	South end of TR. 2.21
198	2	22	NW	Investigation of pits, into flooding NW-SE linear features at south end of TR. 2.21
199	2	22	NW	Investigation of pits, into flooding NW-SE linear features at south end of TR. 2.21
200	2	22	N	Investigation of pits, into flooding NW-SE linear features at south end of TR. 2.21
201	2	22	NW	NW-SE linear feature in TR. 2.21
202	2	22	NW	NW-SE linear feature in TR. 2.21
145940	3	Samsung A51	N	Centre trench TR. 3.3
150011	3	Samsung A51	W	Mid-excavation of southern trench TR3.18
150423	3	Samsung A51	W	Furrows in TR. 3.18 orientated NW-SE
153819	3	Samsung A51	W	Furrow in west side of TR. 3.18
152326	3	Samsung A51	SE	Furrow in area of heavy agricultural activity, TR. 3.18
155344	3	Samsung A51	SE	Linear features crossing TR. 3.18
160917	3	Samsung A51	SE	TR. 3.18 showing regular N-S linear features at west end of trench
160928	3	Samsung A51	SE	TR. 3.18 showing regular N-S linear features at west end of trench
161917	3	Samsung A51	ESE	General view, TR. 3.18

Photo No.	Area	Camera No.	Direction Facing	Description
85106	3	Samsung A51	N	South part of field boundary C149 TR. 3.3
90513	3	Samsung A51	W	Furrow C151 with charcoal on the surface
90517	3	Samsung A51	W	Furrow C151 with charcoal on the surface
90949	3	Samsung A51	W	Linear feature C153 with charcoal on the surface, TR. 3.3
91547	3	Samsung A51	W	Natural yellow stone marked as anomaly, TR. 3.18
91552	3	Samsung A51	W	Natural yellow stone marked as anomaly, TR. 3.18
93543	3	Samsung A51	SW	Linear feature C157, NE facing section, TR. 3.18
93548	3	Samsung A51	SW	Linear feature C157, NE facing section, TR. 3.18
93604	3	Samsung A51	NW	C157 crossing TR. 3.18
94456	3	Samsung A51	W	Shot of C163 and C165, TR. 3.18
95339	3	Samsung A51	SW	Investigation of linear feature TR. 3.18
204	3	22	SSE	Pre-excavation, Area 3
205	3	22	SE	Pre-excavation, Area 3
206	3	22	W	Post-excavation TR. 3.1
207	3	22	N	Slot in field boundary filled with burnt mound material, TR. 3.1
208	3	22	W	Slot in field boundary filled with burnt mound material, TR. 3.1
209	3	22	W	Slot in field boundary filled with burnt mound material, TR. 3.1
210	3	22	E	Slot in field boundary filled with burnt mound material, TR. 3.1
211	3	22	E	Slot in field boundary filled with burnt mound material, TR. 3.1
212	3	22	S	General shot, TR. 3.3
213	3	22	NE	General shot, TR. 3.4
214	3	22	NE	General shot, TR. 3.5
215	3	22	NE	Pit C091, TR. 3.3
216	3	22	NE	Pit C091, TR. 3.3
217	3	22	NE	Ditches C093 and C095, TR. 3.6
218	3	22	NE	Ditches C093 and C095, TR. 3.6
219	3	22	S	Pit C099, TR. 3.5
220	3	22	NW	Ditch C097, TR. 3.4
221	3	22	NE	Ditch C097, TR. 3.4

Photo No.	Area	Camera No.	Direction Facing	Description
222	3	22	SW	Possible pit C101, TR. 3.22
223	3	22	W	Linear feature C103, TR. 3.6
224	3	22	S	General shot, TR. 3.6
225	3	22	W	General shot, TR. 3.5
226	3	22	NW	General shot, TR. 3.22
227	3	22	S	Possible pit C105, TR. 3.7
228	3	22	E	Possible pit C107, TR. 3.7
229	3	22	SE	Pit C109, TR. 3.8
230	3	22	S	Possible pit C111, truncated by furrow C113, TR. 3.7
231	3	22	S	Cut of possible pit C115, TR. 3.7
232	3	22	SW	Possible stake-holes C117 and C119, TR. 3.7
233	3	22	SW	Possible stake-hole C121, TR. 3.7
234	3	22	SE	Possible pit C123, TR. 3.7
235	3	22	S	Possible pit C125, TR. 3.7
236	3	22	E	Possible stake-holes C127 and C129, TR. 3.7
237	3	22	NW	Pit C131, TR. 3.7
238	3	22	NE	Post-excavation of eastern half of TR. 3.8
239	3	22	E	Post-excavation of TR. 3.7
240	3	22	W	Southern part of field boundary, TR. 7.3
241	3	22	W	Field boundary possibly anomaly M12, TR. 3.3
242	3	22	S	Possible pit C133, truncated by furrow C135, TR. 3.8
243	3	22	W	Possible stake-hole C137, possible post-hole C139 and possible pit C141, TR. 3.8
244	3	22	W	Linear feature C143, TR. 3.8
245	3	22	NE	General shot, TR. 3.9
246	3	22	NE	General shot, TR. 3.8
247	3	22	NW	Field boundary. TR. 3.3
248	3	22	NE	Field boundary. TR. 3.3
249	3	22	S	Section in linear feature, TR. 3.3
250	3	22	W	Section in linear feature, TR. 3.3
251	3	22	E	Surface burning, TR. 3.3
252	3	22	S	Surface burning, TR. 3.3
253	3	22	S	Pit C145, TR. 3.10
254	3	22	S	Pit C145, TR. 3.10
255	3	22	SW	Linear feature C151 in TR. 3.18
256	3	22	E	Linear feature C151 in TR. 3.18
257	3	22	S	Linear feature C151 in TR. 3.18
258	3	22	W	Linear feature C151 in TR. 3.18
259	3	22	W	Section through ditches C163, C165, TR. 3.18
260	3	22	W	Section through ditches C163, C165, TR. 3.18
261	3	22	SW	Section through ditches C163, C165, TR. 3.18
262	3	22	S	Section through C157, TR. 3.18
263	3	22	E	Section through C157, TR. 3.18

Photo No.	Area	Camera No.	Direction Facing	Description
264	3	22	NW	Investigation of furrows, TR. 3.16
265	3	22	SSE	Section in linear feature C200, TR. 3.16
266	3	22	SSE	Section in linear feature C200, TR. 3.16
267	3	22	SSE	Section in linear feature C200, TR. 3.16
268	3	22	E	General shot, TR. 3.16
269	3	22	E	General shot, TR. 3.16
270	3	22	W	Shot of west end of TR. 3.16 with linear features
271	3	22	W	Shot of west end of TR. 3.16 with linear features
272	3	22	SW	Natural yellow stone marked as anomaly, TR. 3.16
273	3	22	N	Section in C204, east end, TR. 3.13
274	3	22	N	Section in C204, east end, TR. 3.13
275	3	22	N	Section in C206, TR. 3.13
276	3	22	NNW	Section in C206, TR. 3.13
277	3	22	SE	Mid-excavation of pit C208, TR. 3.13
278	3	22	S	Possible pit/post-hole C210, TR. 3.13
279	3	22	NW	Possible pit/post-hole C210, TR. 3.13
280	3	22	SSW	Section in C212, TR. 3.13
281	3	22	SSW	Section in C214, TR. 3.13
282	3	22	E	Shot of C212 and C214, TR. 3.13
283	3	22	ENE	General shot, TR. 3.13
284	3	22	N	Section of C216, eastern end of TR. 3.14
285	3	22	N	Section of C216, eastern end of TR. 3.14
286	3	22	N	Shot in section in C218, to west of C216
287	3	22	N	Shot in section in C218, to west of C216
288	3	22	E	Shot of C218
289	3	22	WSW	Shot of furrows in TR. 3.14
290	3	22	SW	Working shot, investigating C200, C202 in TR. 3.14
291	3	22	S	Section in C200 and C202, TR. 3.14
292	3	22	S	Section in C200 and C202, TR. 3.14
293	3	22	WSW	Section in C200 and C202, TR. 3.14
294	3	22	SW	C220 in west end, TR. 3.14
295	3	22	S	C222 in west end, TR. 3.14
296	3	22	S	C222 in west end, TR. 3.14
297	3	22	ENE	General shot, TR. 3.14
298	3	22	ENE	General shot, TR. 3.14
299	3	22	ESE	General shot, TR. 3.15
300	3	22	NNE	Shot of C200 and C202, TR. 3.15
301	3	22	NNE	Shot of C200 and C202, TR. 3.15
302	3	22	N	Shot of location of anomaly, north of C200 and C202
303	3	22	W	Shot of C200 and C202, TR. 3.17
304	3	22	E	General shot, TR. 3.17

Photo No.	Area	Camera No.	Direction Facing	Description
DJI_0309	2	DJI phantom 4 Pro+		Overview of burnt mound C081
DJI_0310	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0311	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0312	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0313	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0314	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0315	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0316	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0317	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0318	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0319	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0320	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0321	2	DJI phantom 4 Pro+		Overview of burnt mounds C080, C081 and C084
DJI_0322	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C089
DJI_0323	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C090

Photo No.	Area	Camera No.	Direction Facing	Description
DJI_0324	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C091
DJI_0325	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C092
DJI_0326	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C093
DJI_0327	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C094
DJI_0328	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C095
DJI_0329	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C096
DJI_0330	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C097
DJI_0331	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C098
DJI_0332	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C099
DJI_0333	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C100
DJI_0334	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C101
DJI_0335	3	DJI phantom 4 Pro+		Overview of field boundary with burnt mound material C087 and C102

APPENDIX 3 CONTEXT REGISTER

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
1	1	All	Deposit					0.30-0.50	Mid-brown clayey silt	Topsoil
2	1	All	Deposit					0.30-0.50+	Mid-brownish orange gravelly clay	Subsoil
3	1	1.9	Deposit						Irregular deposit of decayed stone. Non-archaeological	Non-archaeological
4	1	1.9	Cut		005		0.55	0.09	Linear feature	Cut of furrow C005
5	1	1.9	Fill	004			0.55	0.09	Purplish brown silty clay with decayed sandstone inclusions	Fill of linear feature C004
6	1	1.11	Cut		007		1.20	0.22	Linear ditch orientated NNW-SSE	Cut of field boundary C007
7	1	1.11	Fill	006			1.20	0.22	Mid-purplish brown silty clay with frequent stones	Fill of field boundary C006
8	1	1.11	Cut		009		1.20	0.20	Linear ditch orientated NNW-SSE	Cut of field boundary C009
9	1	1.11	Fill	008			1.20	0.20	Mid-purplish brown silty clay with frequent stones	Fill of field boundary C008
10	1	1.8	Cut		011		0.80	0.30	Linear feature	Cut of linear feature C011
11	1	1.8	Fill	010			0.80	0.30	Mid-purplish brown silty clay with frequent stones	Fill of linear feature C010
12	1	1.8	Cut		013		0.80	0.30	Linear feature orientated NNW-SSE	Cut of field boundary C013
13	1	1.8	Fill	012			0.80	0.30	Mid-purplish brown silty clay with frequent stones	Fill of field boundary C012
14	1	1.4	Cut		015		1.80	0.30	Linear ditch orientated NW-SE. Gradually sloping sides. Continues into TR. 1.3	Cut of field boundary C015
15	1	1.4	Fill	014			1.80	0.30	Greyish brown sandy silt with frequent small stones	Fill of field boundary C014

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
16	1	1.4	Cut		017		1.10	0.30	Linear ditch orientated NW-SE. Moderate to sharp sloping sides and a flat base. Continues into TR. 1.3	Cut of field boundary C017
17	1	1.4	Fill	016			1.10	0.30	Greyish brown sandy silt with frequent small stones	Fill of field boundary C016
18	1	1.4	Cut		019		1.10	0.30	Linear ditch orientated NW-SE. Moderate to sharp sloping sides and a flat base	Cut of field boundary C019
19	1	1.4	Fill	018			1.10	0.30	Greyish brown sandy silt with frequent small stones	Fill of field boundary C018
20	1	1.4	Cut		021		1.10	0.30	Linear ditch	Cut of field boundary C021
21	1	1.4	Fill	020			1.10	0.30	Greyish brown sandy silt with frequent small stones	Fill of field boundary C020
22	1	1.17	Cut		023		0.80	0.30	Linear ditch orientated SW-NE	Cut of field boundary C023
23	1	1.17	Fill	022			0.80	0.30	Greyish brown sandy silt with frequent small stones	Fill of field boundary C022
24	1	1.17	Cut		025		0.80	0.30	Linear ditch orientated SW-NE	Cut of field boundary C025
25	1	1.17	Fill	024			0.80	0.30	Greyish brown sandy silt with frequent small stones	Fill of field boundary C024
26	2	All	Deposit						Mottled pinkish grey stoney clay	Subsoil in Area 2 and 3
27	2	2.1	Cut		028		0.70	0.80	Linear ditch orientated NE-SW. Almost vertical sides, moderate to sharp break of slope at the base and almost flat base	Cut of field boundary ditch C028. Likely associated with C032
28	2	2.1	Fill	027			0.70	0.80	Orangish grey sandy silt	Fill of field boundary ditch C027

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
29	2	2.1	Cut		030		0.70	0.80	Linear ditch orientated NE-SW. Almost vertical sides, moderate to sharp break of slope at the base and almost flat base	Cut of field boundary ditch C030. Likely associated with C032
30	2	2.1	Fill	029			0.71	0.80	Orangish grey sandy silt	Fill of field boundary ditch C029
31	2	2.3	Deposit				0.40	0.20	Mid-purplish brown silt, orientated E-W	Appears to be natural but occurs in very linear band
32	2	2.2	Cut		033		2.50	0.90	Linear ditch, orientated SE-NW	Cut of ditch C033
33	2	2.2	Fill	032			2.50	0.90	Orangish grey sandy silt	Fill of ditch C032
34	2	2.7	Cut		0.35		1.30	0.56	Linear ditch	Cut of ditch C035. Same as C040 and C059
35	2	2.7	Fill	034			1.30	0.15	Dark brownish grey sandy silt	Basal fill of ditch C034
36	2	2.7	Fill	034			1.30	0.15	Mid-brownish orange silt	Middle fill of ditch C034
37	2	2.7	Fill	034			1.30	0.16	Mid-brownish grey clayey silt	Upper fill of ditch C034
38	2	2.4	Cut		039		1.20	0.15	Linear ditch	Cut of furrow/agricultural feature C039
39	2	2.4	Fill	038			1.20	0.15	Purplish grey clay	Fill of furrow/agricultural feature C038
40	2	2.18	Cut		041				Same as C034	Same as C034, C059
41	2	2.18	Fill	040					Same as C034	Same as C034
42	2	2.17	Cut		043	1.35	1.35	0.12	Circular in plan. Break of slope top and base imperceptible (SW), side gently sloping (SW)	Cut of pit C043
43	2	2.17	Fill	042		1.35	1.35	0.02	80% charcoal with grey silt	Basal fill of pit C042
44	2	2.17	Fill	042		1.35	1.35	0.10	Mid purplish brown silt with heat affected clay	Upper fill of pit C042

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
45	2	2.17	Cut		046		1.20	0.40	Linear feature. Orientated NE-SW. 'V'-shaped profile	Cut of linear feature C046
46	2	2.17	Fill	045			1.20	0.40	Compact grey stoney clay	Fill of linear feature C045
47	2	2.17	Cut		048		0.50	0.35	Linear feature, orientated SE-NW	Cut of linear feature C048
48	2	2.17	Fill				0.50	0.35	Compact grey stoney clay	Fill of linear feature C047
49	2	2.15	Cut		050	0.50	0.50	0.10	Circular in plan	Cut of pit C050
50	2	2.15	Fill	049		0.50	0.50	0.10	Mid greyish brown silty clay	Fill of pit C049
51	2	2.12	Cut		052	0.90	0.80	0.30	Sub-circular in plan, orientated N-S	Cut of pit C052
52	2	2.12	Fill	051		0.90	0.80	0.30	Dark-brownish grey silt with occasional small stones	Fill of pit C051
53	2	2.16	Cut		054	0.47	0.37	0.06	Sub-circular in plan, orientated N-S	Cut of pit C054
54	2	2.16	Fill	053		0.47	0.37	0.06	Mid-greyish brown sandy silt with 40% charcoal	Fill of pit C053
55	2	2.12	Cut		056	0.65	0.60	0.22	Sub-circular in plan. Sharp break of slope on top, near vertical sides and gradual break of slope on bottom	Cut of pit C056
56	2	2.12	Fill	055		0.65	0.60	0.22	Dark greyish black clayey silt with frequent heat-affected stones and occasional charcoal flecks	Fill of pit C055
57	2	2.12	Cut		058		1	0.25	Cut of linear ditch. Side steeper to north side with an almost flat base	Cut of field boundary C058. Also seen continuing in TR. 2.11. Seen on geophysics
58	2	2.12	Fill	057			1	0.25	Greyish brown clayey silt with occasional stone	Fill of field boundary C057. Also seen continuing in TR. 2.11. Seen on geophysics

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
59	2	2.12	Cut		060, 061		1.60	0.70	Linear ditch	Cut of linear ditch C060 and C061. Corresponds to anomaly M14. Continues into TR. 2.24. Same as C040, C034
60	2	2.12	Fill	059			1.60	0.40	Greyish brown silty clay	Upper fill of linear ditch C059
61	2	2.12	Fill	059			0.80	0.30	Brownish grey silty clay	Lower fill of linear ditch C059
62	2	2.27	Cut		063	0.70	0.50	0.20	Sub-oval in plan. Orientated NW-SE	Cut of possible pit C063
63	2	2.27	Fill	062		0.70	0.50	0.20	Brown silty clay with a concentration of charcoal on the northern side	Fill of possible pit C062
64	2	2.27	Cut		065		1.40	0.20	Linear feature orientated NE-SW. Shallow, sloping sides	Cut of furrow/agricultural feature C065
65	2	2.27	Fill	064			1.40	0.20	Grey silty clay	Fill of furrow/agricultural feature C064
66	2	2.32	Cut		067		2	0.20	Linear ditch with shallow, sloping sides and an almost flat base	Cut of parallel field boundary C067, east. Corresponds to anomaly M7
67	2	2.32	Fill	066			2	0.20	Mottled brownish grey clayey silt	Fill of parallel field boundary C066, east. Corresponds to anomaly M7
68	2	2.32	Cut		069		1.80	0.60	Linear ditch	Cut of parallel field boundary C069, west. Corresponds to anomaly M7
69	2	2.32	Fill	068			1.80	0.60	Mottled brownish grey clayey silt	Fill of parallel field boundary C068, west. Corresponds to anomaly M7
70	2	2.31	Cut		071	1.40	0.60	0.15	Irregular in plan, orientated NW-SE	Cut of pit C071
71	2	2.31	Fill	070		1.40	0.60	0.15	Mottled brown silty clay with frequent slag	Fill of pit C070
72	2	2.31	Cut		073	0.90	0.35	0.10	Oval in plan, orientates NW-SE	Cut of pit C073. Heat affected patch of soil noted east of possible pit, may be anomaly M8 on geophysics

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
73	2	2.31	Fill	072		0.90	0.35	0.10	Dark grey clayey silt with occasional charcoal and heat affected stone	Fill of pit C072
74	2	2.27	Cut		075	1.10	0.40	0.15	Linear feature orientated E-W	Probable field clearance
75	2	2.27	Fill	074		0.60	0.15	0.15	Charcoal-rich fill along the northern edge. In-situ burning on surface	Probable field clearance
76	2	2.30	Cut		077		1.30	0.55	Linear feature orientated NE-SW	Cut of linear feature C077, anomaly M8
77	2	2.30	Fill	076			1.30	0.55	Grey stoney silt	Cut of linear feature C076
78	2	2.26	Deposit			1.60	0.80	0.08	Oval in plan, orientated N-S. Charcoal rich silt	Charcoal-rich deposit. May account for anomaly M6
79	2	2.24	Deposit			1.90	0.35	0.15	Linear in plan, orientated SE-NW. Charcoal rich silt	Charcoal-rich deposit
80	2	2.21	Deposit			21.50	19	0.30	Dark brown to black clayey silt with moderate amounts of charcoal and abundant small to medium heat affected stone. Cut by parallel NW-SE orientated linear features in the south end of the trench (1m wide, 0.30m deep)	Burnt mound/*fulacht fiadh*. Corresponds to geophysical anomaly
81	2	2.19	Deposit			18.65	10.70	0.50+	Dark brown to black clayey silt with moderate amounts of charcoal and abundant small heat affected stone	Burnt mound/*fulacht fiadh*. Corresponds to geophysical anomaly
82	2	2.26	Cut				1.20	0.2	Linear in plan, orientated E-W	Cut of ditch C083. Corresponds with anomaly M6 on geophys
83	2	2.26	Fill				1.20	0.2	Mid grey clayey silt	Fill of ditch C082.

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
84	2	2.20	Deposit			0.40	11	0.20	Dark brown to black clayey silt with moderate amounts of charcoal and abundant small heat affected stone	Burnt mound/*fulacht fiadh*. Corresponds to geophysical anomaly
85	2	2.22	Deposit			0.85	0.58		Charcoal-rich silt with large heat affected stones. Orientated SE-NW	Charcoal-rich deposit
86	2	2.23	Deposit			1.50	1	0.20+	Charcoal-rich silt with large heat affected stones. Orientated SE-NW	Charcoal-rich deposit
87	3	3.1	Cut		88		2		Linear ditch orientated SE-NW	Cut of Field Boundary (W side). Parallel to C089. Corresponds to geophysical anomaly
88	3	3.1	Fill	87			2		Dark brown to black clayey silt with moderate amounts of charcoal and abundant small heat affected stone.	Burnt mound/*fulacht fiadh* material levelled into later field boundary. Corresponds to geophysical anomaly.
89	3	3.1	Cut		90		2.40	0.30	Linear ditch orientated SE-NW	Cut of Field Boundary (E side)
90	3	3.1	Fill	89					Burnt mound material fill of linear cut C89	Burnt mound/*fulacht fiadh* material levelled into later field boundary. Corresponds to geophysical anomaly
91	3	3.3	Cut		92	0.35	0.28	0.13	Small sub-circular pit	Cut of small pit C092
92	3	3.3	Fill	91		0.35	0.28	0.13	Charcoal-rich silty clay and frequent stone	Burnt fill of pit C91
93	3	3.6	Cut		94		1.50	0.30	Linear ditch, orientated N-S	Cut of ditch C094, corresponds to anomaly M7
94	3	3.6	Fill	93			1.50	0.30	Mid greyish brown silty clay	Fill of ditch C93
95	3	3.6	Cut		96		1.50	0.30	Linear ditch, orientated N-S	Cut of ditch C096, corresponds to anomaly M7

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
96	3	3.6	Fill	95			1.50	0.30	Mid greyish brown silty clay	Fill of ditch C95
97	3	3.4	Cut		98		2.50	0.40	Linear ditch	Cut of ditch C98
98	3	3.4	Fill	97			2.50	0.40	Mid greyish brown silty clay	Fill of ditch C97
99	3	3.5	Cut		100	0.35	0.30	0.12	Circular in plan. Truncated by furrow	Cut of pit C100
100	3	3.5	Fill	99			0.30	0.12	Mid greyish brown silty clay with charcoal flecks	Fill of pit C99
101	3	3.22	Cut		102		0.35	0.30	Circular in plan	Cut of pit C102
102	3	3.22	Fill	101			0.35	0.30	Mid greyish brown silty clay with charcoal flecks	Fill of pit C101
103	3	3.6	Cut		104		0.60	0.15	Linear in plan	Cut of linear feature C104.
104	3	3.6	Fill	103			0.60	0.15	Brownish grey silty clay	Fill of linear feature C103
105	3	3.8	Cut		106	0.60	0.39	0.12	Oval in plan	Cut of possible pit C106
106	3	3.8	Fill	105			0.39	0.12	Mottled dark brown grey silty clay with charcoal and small stones	Fill of possible pit C105
107	3	3.8	Cut		108	0.60	0.50		Sub-circular in plan	Cut of possible pit C108
108	3	3.8	Fill	107		0.60	0.50		Dark brown silty clay	Fill of possible pit C107
109	3	3.8	Cut		110	1.80	1.30	0.22	Sub-oval in plan	Cut of large pit C110
110	3	3.8	Fill	109		1.80	1.30	0.22	Mid-greyish-brown silty	Fill of large pit C109
111	3	3.8	Cut		112	0.60	0.30	0.28	Sub-oval in plan	Cut of possible pit C112, truncated by furrow
112	3	3.8	Fill	111		0.60	0.30	0.28	Dark greyish-brown silty clay	Fill of possible pit C111
113	3	3.8	Cut		114		0.40	0.20	Linear in plan	Cut of furrow C114, truncating C111
114	3	3.8	Fill	113			0.40	0.20	Mid-greyish-brown sandy silt	Fill of furrow C113
115	3	3.8	Cut		116	0.45	0.30		Sub-oval in plan	Cut of possible pit C0116
116	3	3.8	Fill	115		0.45	0.30		Charcoal-rich silty clay	Fill of possible pit C115

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
117	3	3.8	Cut		118	0.10	0.10		Circular in plan	Cut of possible stake-hole C118
118	3	3.8	Fill	117		0.10	0.10		Charcoal-rich silty clay	Fill of possible stake-hole C117
119	3	3.8	Cut		120	0.12	0.12		Circular in plan	Cut of possible stake-hole C120
120	3	3.8	Fill	119		0.12	0.12		Charcoal-rich silty clay	Fill of possible stake-hole C119,
121	3	3.8	Cut		122	0.27	0.15		Irregular in plan	Cut of possible stake-hole C122
122	3	3.8	Fill	121		0.27	0.15		Charcoal-rich silty clay	Fill of possible stake-hole C121
123	3	3.8	Cut		124	0.66	0.50		Sub-circular in plan	Cut of possible pit C124
124	3	3.8	Fill	123		0.66	0.50		Mid-greyish-brown sandy silt	Fill of possible pit C123
125	3	3.8	Cut		126	0.67	0.56		Sub-circular in plan	Cut of possible pit C126
126	3	3.8	Fill	125		0.67	0.56	0.17	Dark grey-brown silty clay	Fill of possible pit C125
127	3	3.8	Cut		128	0.15	0.15		Circular in plan	Cut of stake-hole C128
128	3	3.8	Fill	127		0.15	0.15		Mid-greyish-brown silt, frequent charcoal on surface	Fill of stake-hole C127
129	3	3.8	Cut		130	0.20	0.05		Irregular in plan, orientated SE-NW	Cut of stake-hole C130
130	3	3.8	Fill	129		0.20	0.05		Mid-greyish-brown silt, frequent charcoal on surface	Fill of stake-hole C129
131	3	3.8	Cut		132	0.26	0.24		Circular in plan	Cut of pit C132
132	3	3.8	Fill	131		0.26	0.24		Mid greyish brown silt with frequent charcoal on surface	Fill of pit C131
133	3	3.10	Cut		134	1.40	0.50		Irregular in plan	Cut of possible pit C134
134	3	3.10	Fill	133		1.40	0.50		Dark brownish-grey silt with charcoal	Fill of possible pit C133
135	3	3.10	Cut		136		0.50		Linear feature	Cut of furrow C136, truncating C133
136	3	3.10	Fill	135			0.50		Mid-greyish-brown silt	Fill of furrow C135
137	3	3.10	Cut		138	0.17	0.12		Sub-circular in plan	Cut of possible stake-hole C138
138	3	3.10	Fill	137		0.17	0.12		Light grey-brown sandy silt	Fill of possible stake-hole C137

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
139	3	3.10	Cut		140	0.30	0.23		Sub-circular in plan	Cut of possible post-hole C140
140	3	3.10	Fill	139		0.30	0.23		Dark brown-grey silt containing charcoal	Fill of possible post-hole C139
141	3	3.10	Cut		142	0.80	0.70	0.23	Irregular in plan	Cut of possible pit C142
142	3	3.10	Fill	141		0.80	0.70	0.23	Mottled dark brownish-grey silty clay	Fill of possible pit of C141
143	3	3.10	Cut		144		0.65	0.25	Linear feature	Cut of linear feature C144, truncated by furrows
144	3	3.10	Fill	143			0.65	0.25	Mottled dark brownish-grey silty clay with frequent stones and charcoal	Fill of linear feature C143
145	3	3.12	Cut		146	0.40	0.40	0.20		Cut of pit C146
146	3	3.12	Fill	145		0.40	0.40	0.20	Dark grey-brown silty with heat affected stone	Fill of pit C145
147	3	3.3	Cut		148		0.80		Linear in plan	Cut of field boundary C148, corresponds with anomaly 7
148	3	3.3	Fill	147			0.80		Mid-greyish-brown silt	Fill of field boundary C147
149	3	3.3	Cut		150		0.80		Linear in plan	Cut of field boundary C150, corresponds with anomaly 7
150	3	3.3	Fill	149			0.80		Mid-greyish-brown silt	Fill of field boundary C149
151	3	3.3	Cut		152		0.90		Linear in plan, orientated E-W	Cut of furrow C152
152	3	3.3	Fill	151			0.90		Mid-greyish-brown silt	Fill of furrow C151
153	3	3.3	Cut		154		1.30	0.40	Linear in plan, orientated E-W	Cut of furrow C154
154	3	3.3	Fill	153			1.30	0.40	Mid-grey silty clay	Fill of furrow C153
155	3	3.12	Cut		156		0.70		Linear in plan	Cut of linear feature C156
156	3	3.18	Fill	155			0.70		Mid-grey silty clay	Fill of linear feature C155

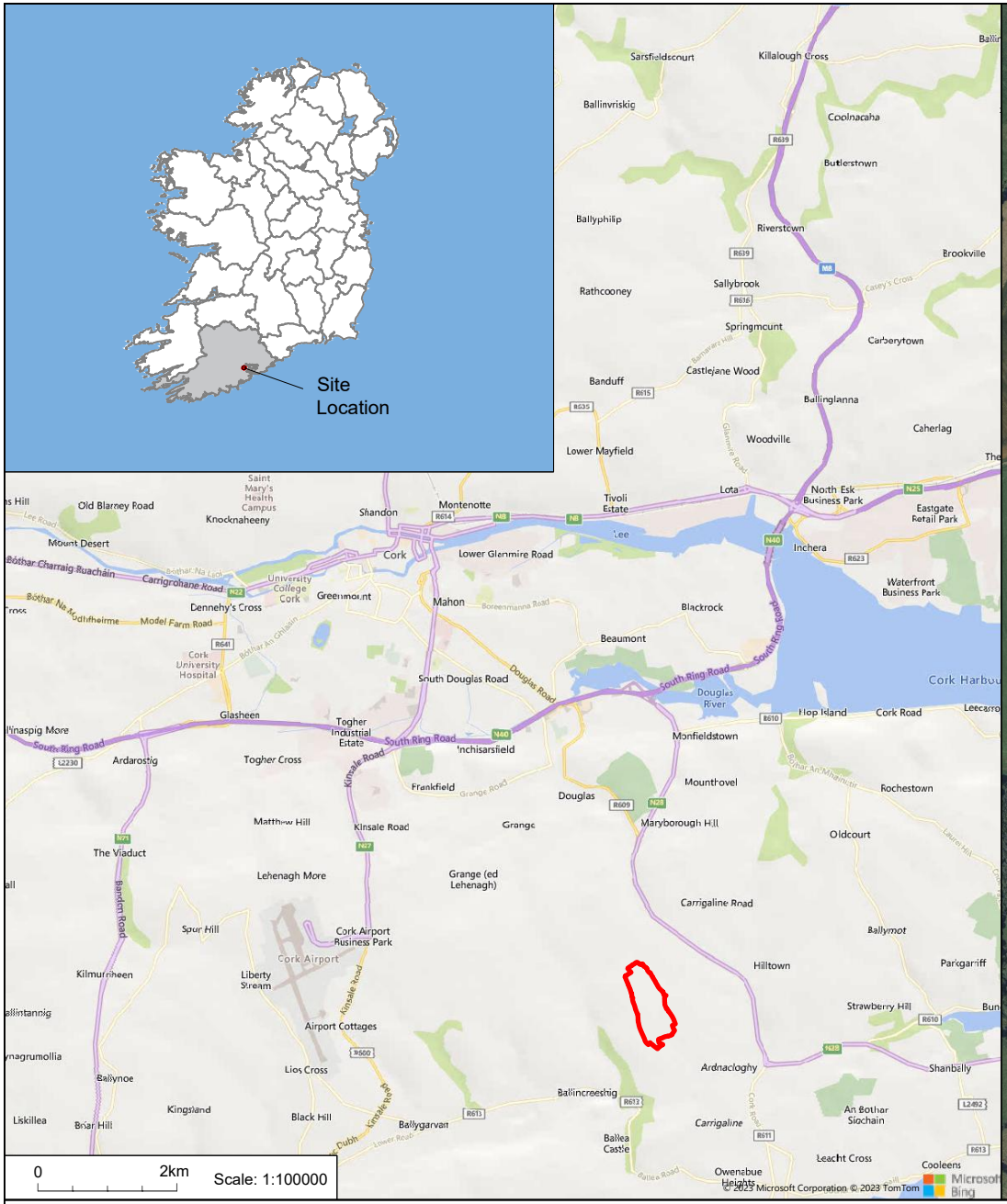
Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
157	3	3.18	Cut		158		1.50	0.40	Linear in plan, orientated NE-SW	Cut of agricultural linear feature C158
158	3	3.18	Fill	157			1.50	0.40	Greyish-brown clayey silt	Fill of agricultural linear feature C157
159	3	3.18	Cut		160		0.80		Linear in plan	Cut of agricultural linear feature C160
160	3	3.18	Fill	159			0.80		Mid-grey silty clay	Fill of agricultural linear feature C159
161	3	3.18	Cut		162		1.30	0.30	Linear in plan	Cut of agricultural linear feature C162
162	3	3.18	Fill	161			1.30	0.30	Dark greyish-brown silty clay	Fill of agricultural linear feature C161
163	3	3.18	Cut		164		1.30	0.40	Linear in plan	Cut of agricultural linear feature C164
164	3	3.18	Fill	163			1.30	0.40	Dark greyish-brown silty clay, frequent charcoal flecks	Fill of agricultural linear feature C163
165	3	3.18	Cut		166		1.30	0.30	Linear in plan, orientated N-S	Cut of agricultural linear feature C166
166	3	3.18	Fill	165			1.30	0.30	Mid-greyish brown silty clay	Fill of agricultural linear feature C165
200	3	3.16	Cut		201		1.20	0.30	Linear feature, orientated NE-SW, sloping sides, sharper to the east with an almost flat base	Cut of agricultural linear feature C201
201	3	3.16	Fill	200			1.20	0.30	Greyish-brown silty clay	Fill of agricultural linear feature C200
202	3	3.16	Cut		203		1.30	0.20	Linear feature, orientated NE-SW, sloping sides with a stoney base	Cut of agricultural linear feature C201

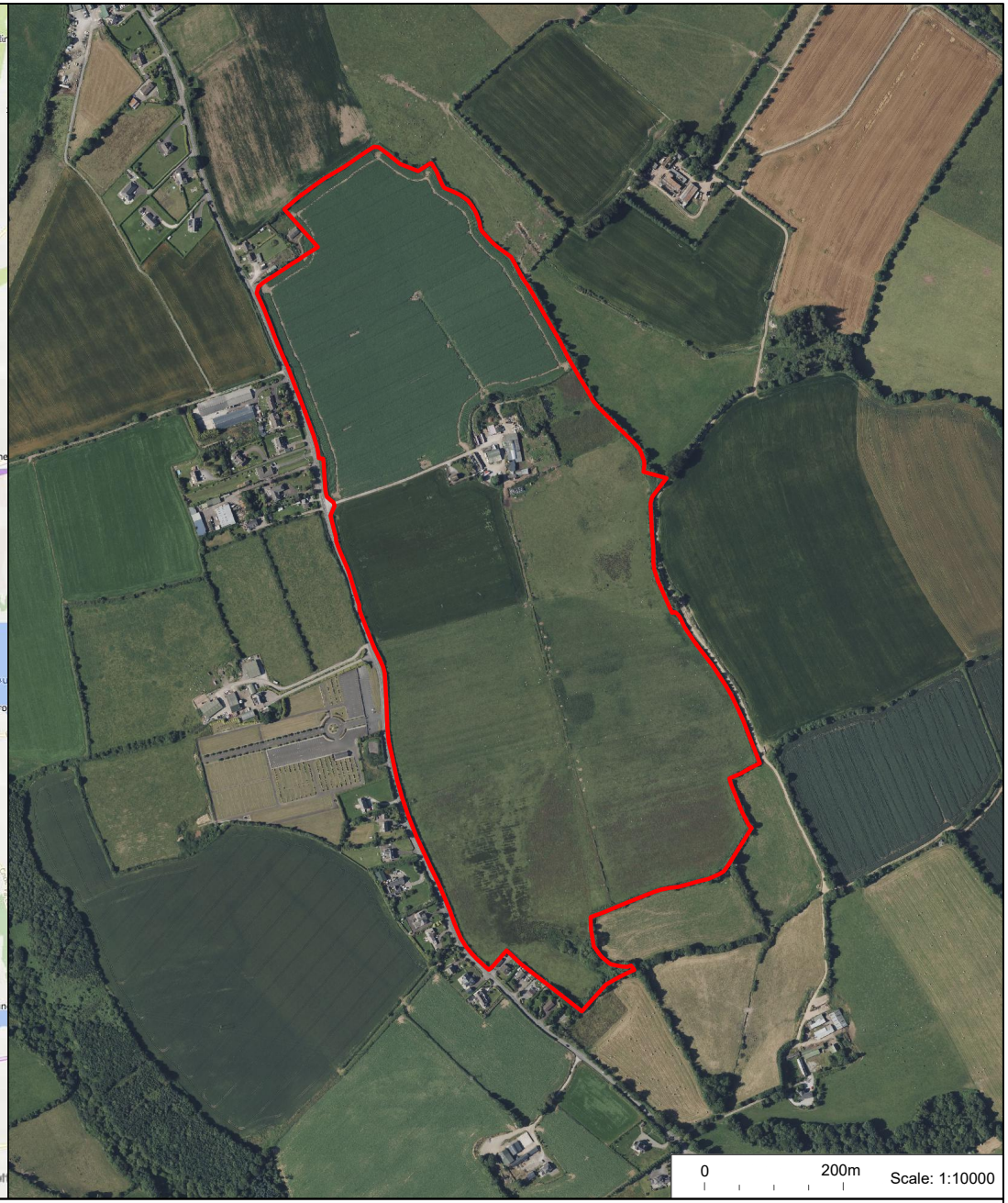
Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
203	3	3.16	Fill	202			1.30	0.20	Greyish-brown silty clay	Fill of agricultural linear feature C202
204	3	3.13	Cut		205		1.20	0.30	Linear feature, orientated NE-SW	Cut of linear feature C205
205	3	3.13	Fill	204			1.20	0.30	Greyish-brown silty clay	Fill of linear feature C204
206	3	3.13	Cut		207		1.40	0.30	Linear feature, orientated NE-SW	Cut of linear feature C207
207	3	3.13	Fill	206			1.40	0.30	Greyish-brown silty clay	Fill of linear feature C206
208	3	3.13	Cut		209		0.40	0.20+	Circular in plan	Cut of pit C209
209	3	3.13	Fill	208			0.40	0.20+	Mid-brownish-grey sandy clay with frequent flecks of charcoal	Fill of pit C208
210	3	3.13	Cut		211	0.40	0.30	0.15	Sub-circular in plan	Cut of pit C211
211	3	3.13	Fill	210		0.40	0.30	0.15	Dark greyish-brown silty clay	Fill of pit C210
212	3	3.13	Cut		213		0.50		Linear feature	Cut of agricultural linear feature C213. Parallel to C214
213	3	3.13	Fill	212			0.50		Brownish-grey silty clay with stone	Fill of agricultural linear feature C212
214	3	3.13	Cut		215		0.70		Linear feature	Cut of agricultural linear feature C215
215	3	3.13	Fill	214			0.70		Brownish-grey silty clay with stone	Fill of agricultural linear feature C214
216	3	3.14	Cut		217		2	0.20	Linear feature, orientated NE-SW	Cut of agricultural linear feature C217
217	3	3.14	Fill	216			2	0.20	Brownish-grey silty clay	Fill of agricultural linear feature C216
218	3	3.14	Cut		219		1.50	0.30	Linear feature, orientated NE-SW	Cut of agricultural linear feature C219
219	3	3.14	Fill	218			1.50	0.30	Brownish-grey silty clay	Fill of agricultural linear feature C220

Context No.	Area	Trench	Type	Fill of	Filled by	Length (m)	Width (m)	Depth (m)	Description	Interpretation
220	3	3.14	Cut		221		1.50		Linear feature	Cut of agricultural linear feature C221
221	3	3.14	Fill	220			1.50		Brownish-grey silty clay	Fill of agricultural linear feature C220
222	3	3.14	Cut		223		1.50		Linear feature	Cut of agricultural linear feature C223
223	3	3.14	Fill	222			1.50		Brownish-grey silty clay	Fill of agricultural linear feature C222
224	1	1.1	Cut		225		0.90	0.12	Linear feature	Cut of field boundary C225, anomaly M7
225	1	1.1	Fill	224			0.90	0.12	Mid-purplish-brown silt with abundant stones	Fill of field boundary C225
226	2	2.2	Cut		227		2.24		Linear feature	Cut of field boundary
227	2	2.2	Fill	226			2.24		Mid-greyish-brown silt	Fill of filed boundary
228	2	2.2	Cut		229		0.90	0.20	Linear feature	Cut of furrow/agricultural feature
229	2	2.2	Fill	228			0.90	0.20	Mid-greyish brown silt	Fill of furrow/agricultural feature
230	2	2.32	Cut		231		2		Linear feature	Cut of agricultural feature
231	2	2.23	Fill	230			2		Mid-greyish brown silt	Fill of agricultural feature

APPENDIX 4 FINDS REGISTER

Find No.	Context No.	Item No.	Material	Simple name	Description	No of parts
23E0323:83:1	083	1	Ceramic	Pottery	1x sherd modern earthenware	1
23E0323:83:2	083	2	Ceramic	Pottery	1x sherd modern earthenware	1
23E0323:83:3	083	3	Ceramic	Pottery	1x sherd modern pottery	1
23E0323:11:1	011	1	Ceramic	Pottery	1x sherd modern pottery	1
23E0323:9:1	009	1	Ceramic	Pottery	1x sherd modern earthenware	1
23E0323:17:1	017	1	Ceramic	Pottery	1x sherd modern earthenware	1





Ballinrea Solar Array, Co. Cork:

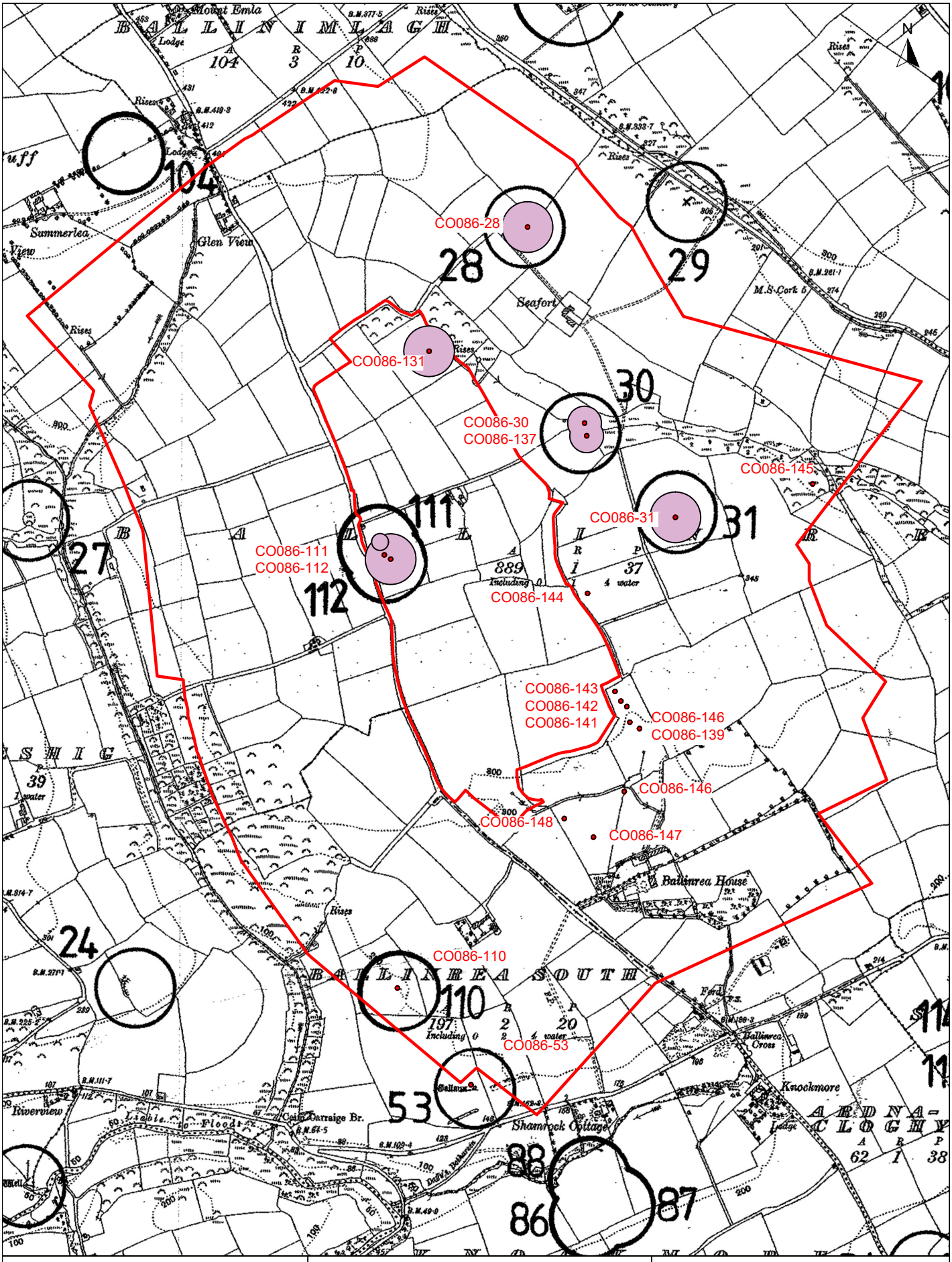
Aerial Mapping: ©Microsoft Corporation 2023

Scheme boundary

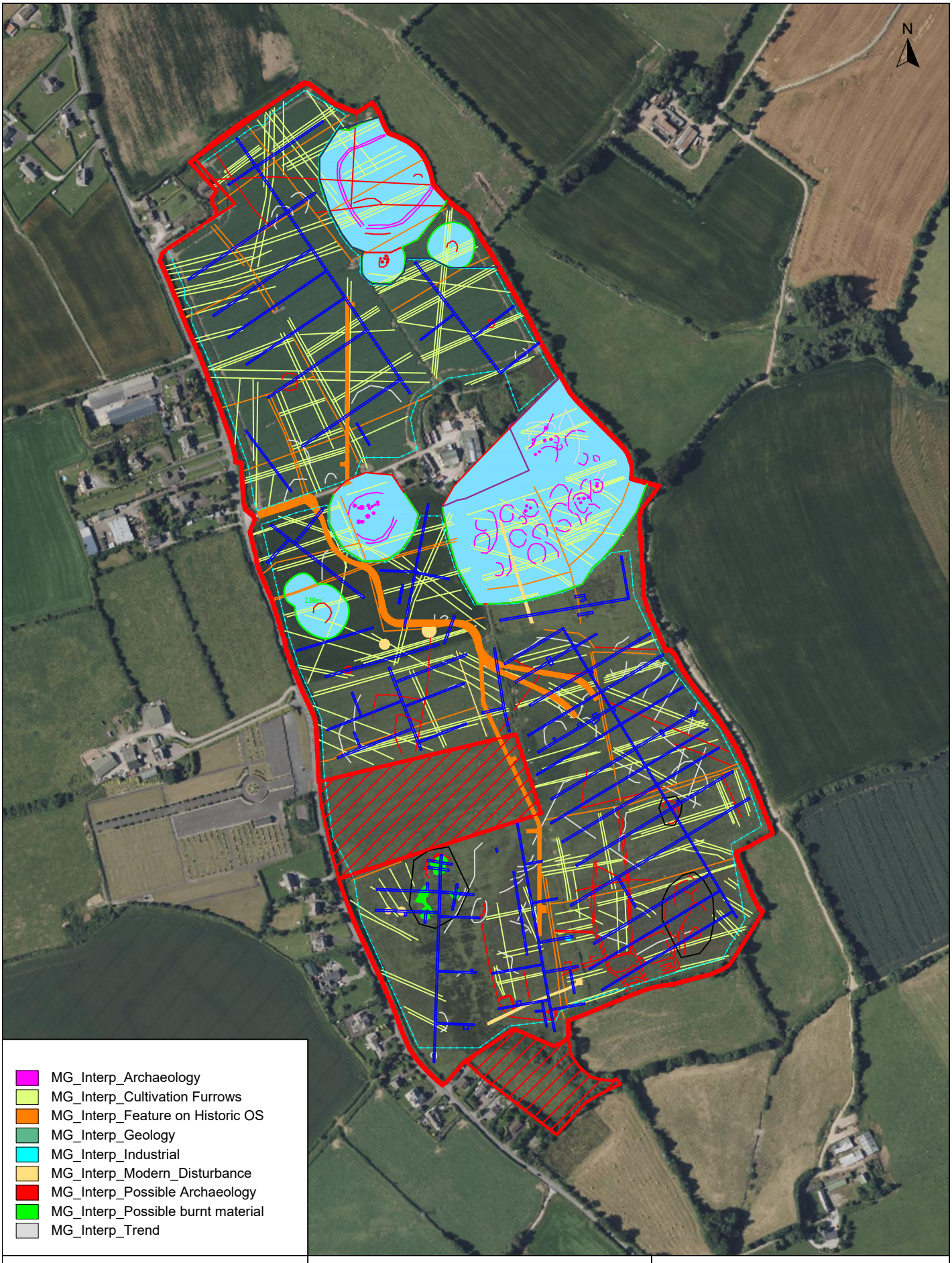
Rubicon Heritage

N

Project Code: RH0786	Prepared by: D.Keane
Drawing Date: 08/11/2023	Checked by: J.McCarthy
Scale: Various	Approved by:B.Sutton
Fig 1: Site location and proposed development layout	



Rubicon Heritage	**Key:** SMR/RMP	Fig 2: Cultural heritage sites and RMPS within the proposed development site
Project code: RH0786		Created by: D. Keane / Revision Number: version 1.0
Scale: 1:12000 @ A4		Approved by: B.Sutton / Date issued: 09/11/2023
		Scale 0 — 500 m



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Project code:
RH0786

Scale:
1:6000 @ A4

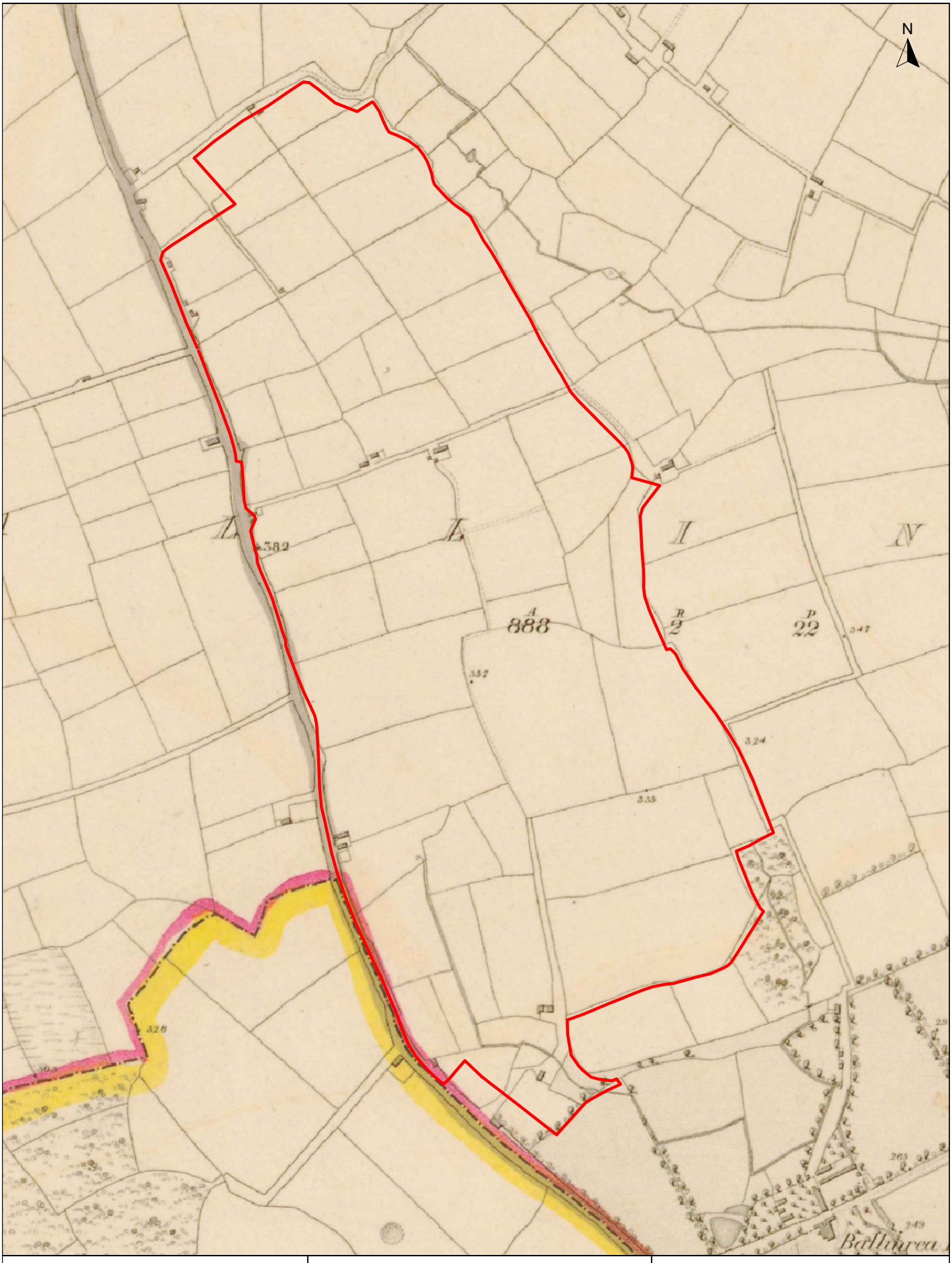
Key:

- Excluded area of Archaeology
- Proposed test trenches
- Proposed Road
- Site boundary
- Outside area of investi
- Fencing

Fig 3: Archaeological testing layout overlaid onto the geophysical survey

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

Scale
0 250 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:6000 @ A4

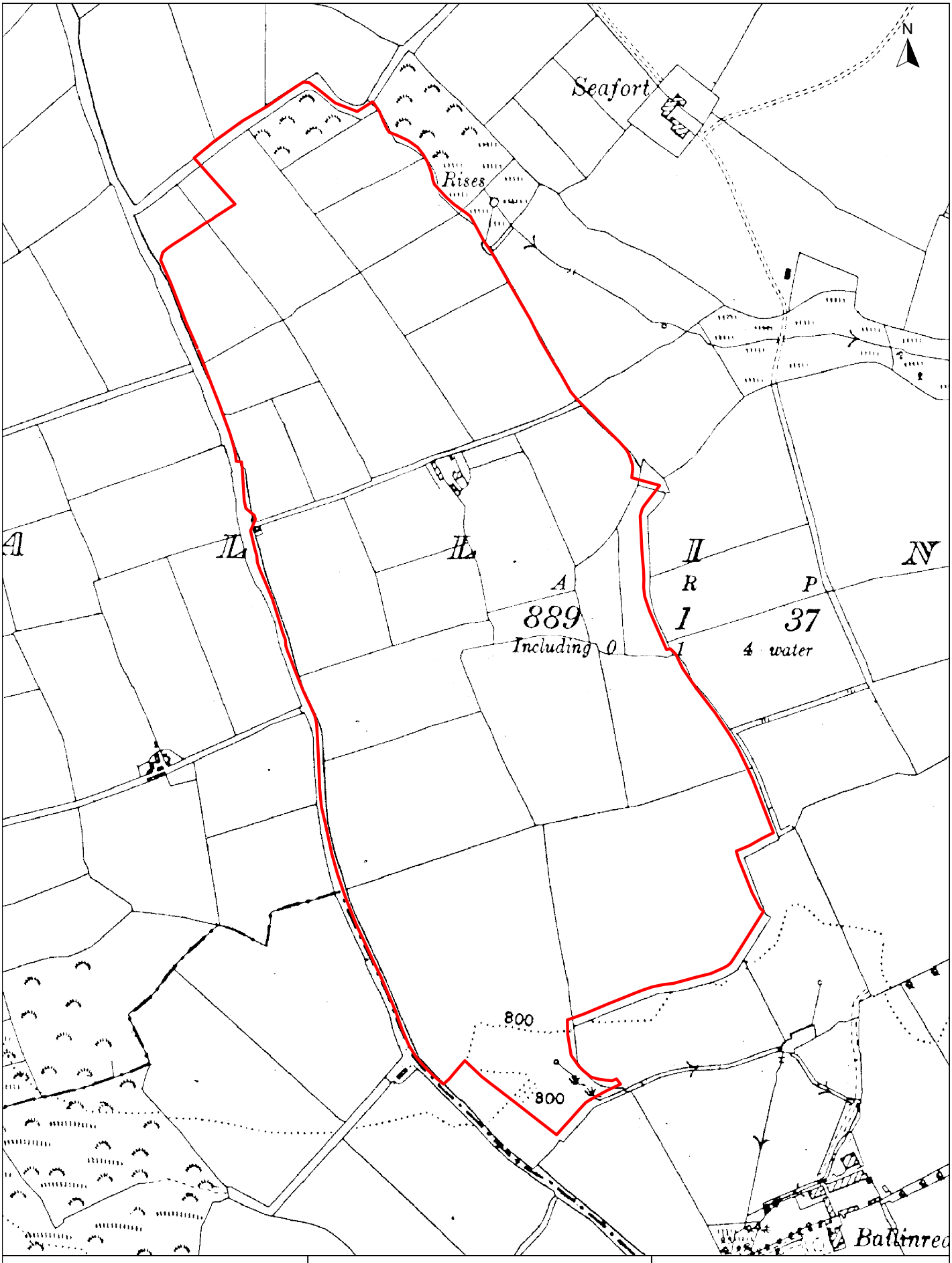
Key:

Site boundary

Fig 4: First edition 6-inch Ordnance Survey map with the proposed development site

Created by:	Revision Number:
D. Keane	version 1.0
Approved by:	Date issued:
B.Sutton	09/11/2023

Scale
0 250 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:6000 @ A4

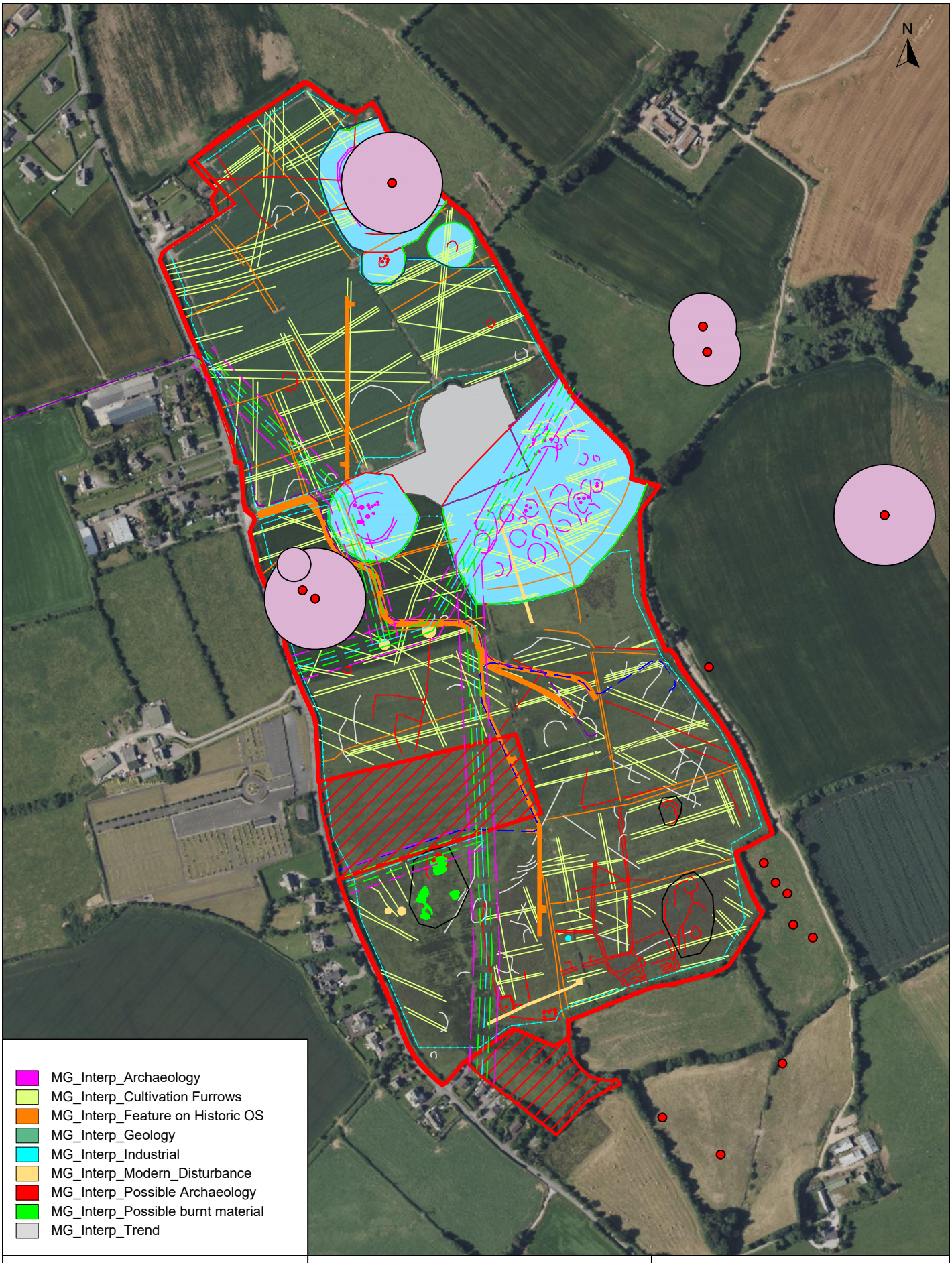
Key:

Site boundary

Fig 5: Second edition 25-inch Ordnance Survey map with the proposed development

Created by:	Revision Number:
D. Keane	version 1.0
Approved by:	Date issued:
B.Sutton	09/11/2023

Scale
0 250 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:6000 @ A4

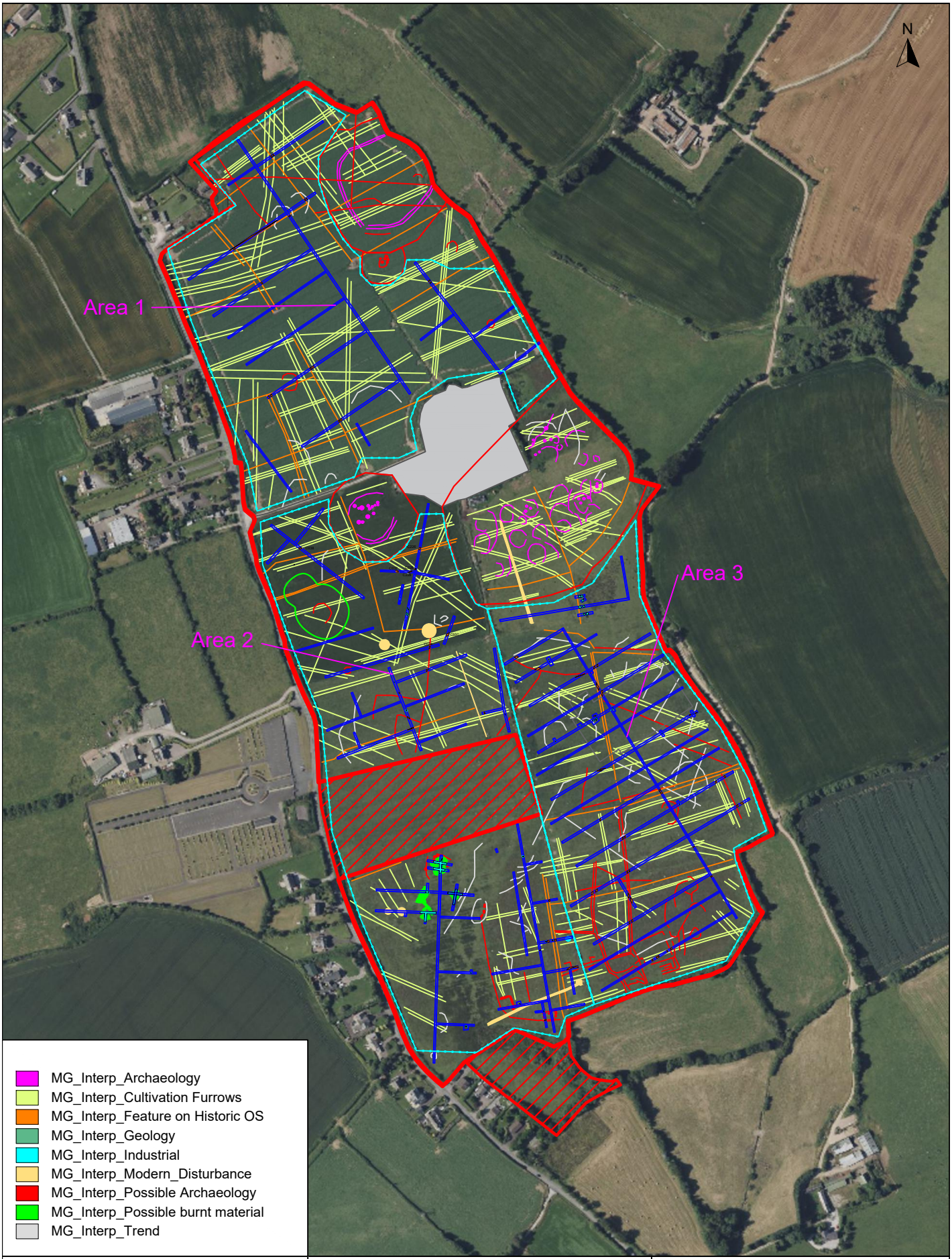
Key:

- Excluded area of Archaeology
- SMR/RMP
- Proposed Road
- Site boundary
- Outside area of investi
- ESB & boundary
- Fencing

Fig 6: Geophysical survey showing cultural heritage sites within development site and proposed mitigation measures

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 250 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:6000 @ A4

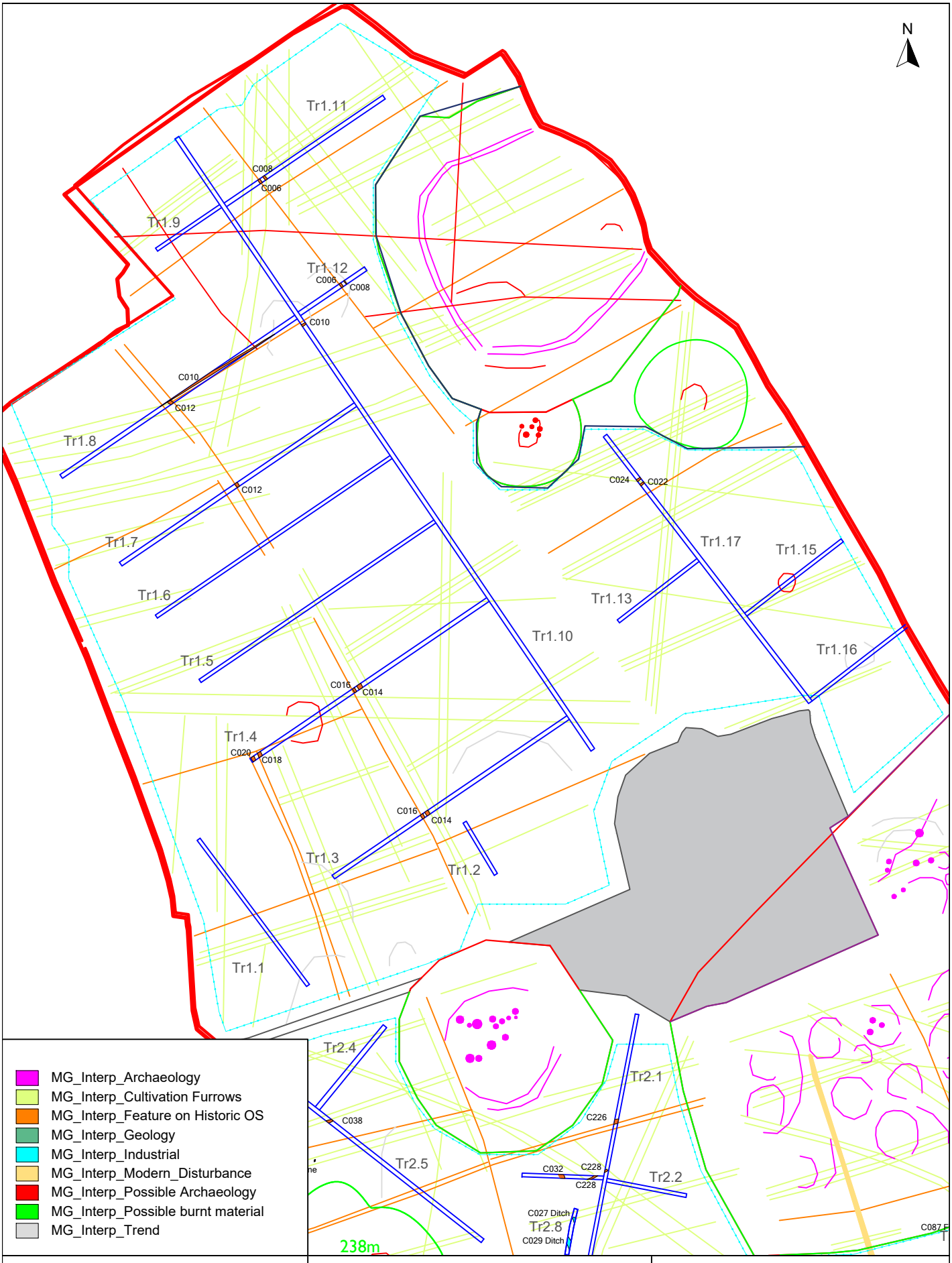
Key:

- Excluded area of Archaeology
- SMR/RMP
- Area Outline
- Trench
- Site boundary
- Outside area of investi

Fig 7: Archaeological testing results overlaid onto the geophysical survey

Created by:	Revision Number:
D. Keane	version 1.0
Approved by:	Date issued:
B.Sutton	09/11/2023

0 Scale 250 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2500 @ A4

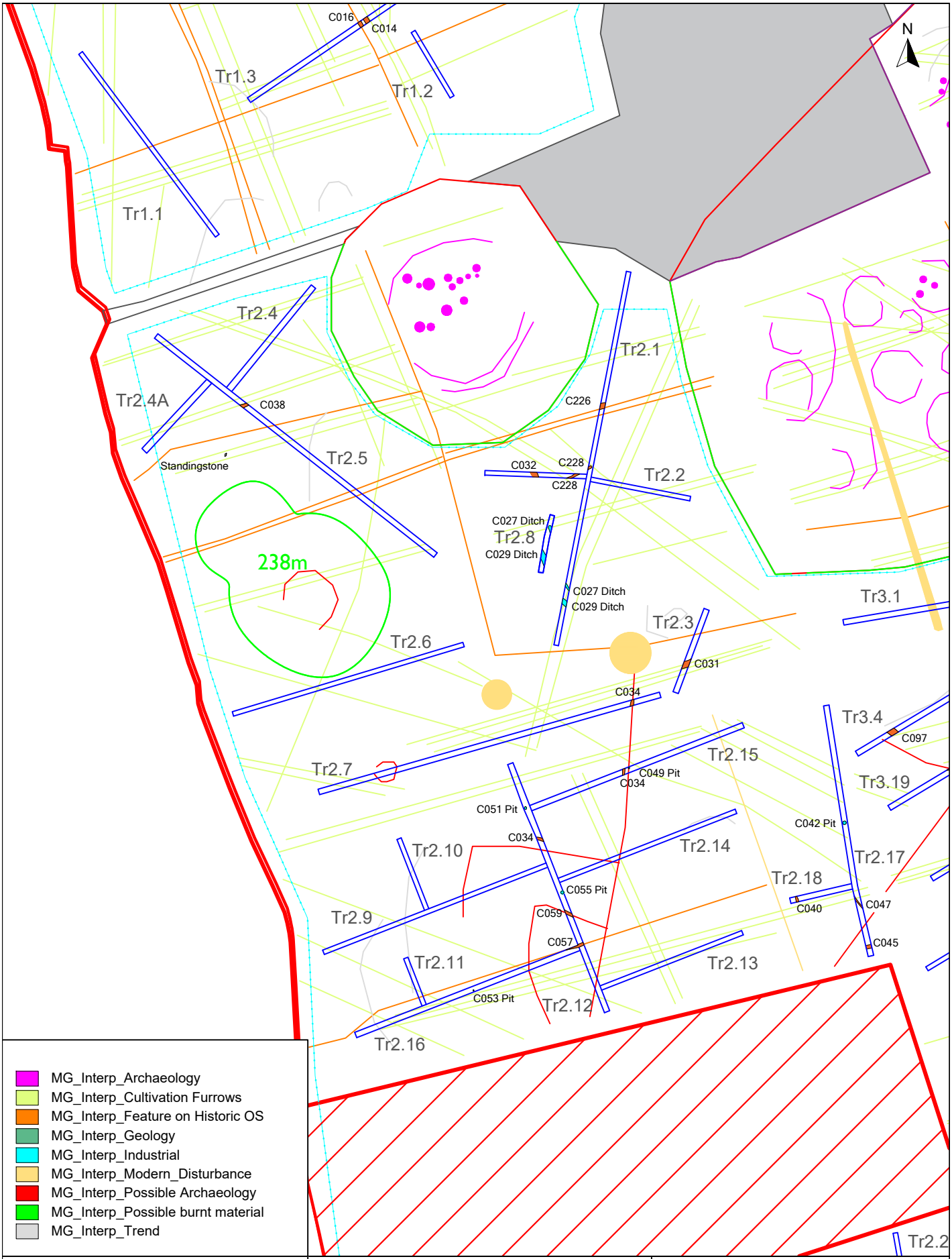
Key:

- Archaeology
- Trench
- Site boundary
- Outside area of investi
- Non-Arc
- Fencing

Fig 8: Close-up of Area 1 Archaeological testing results overlaid onto the geophysical survey

Created by:	Revision Number:
D. Keane	version 1.0
Approved by:	Date issued:
B.Sutton	09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2500 @ A4

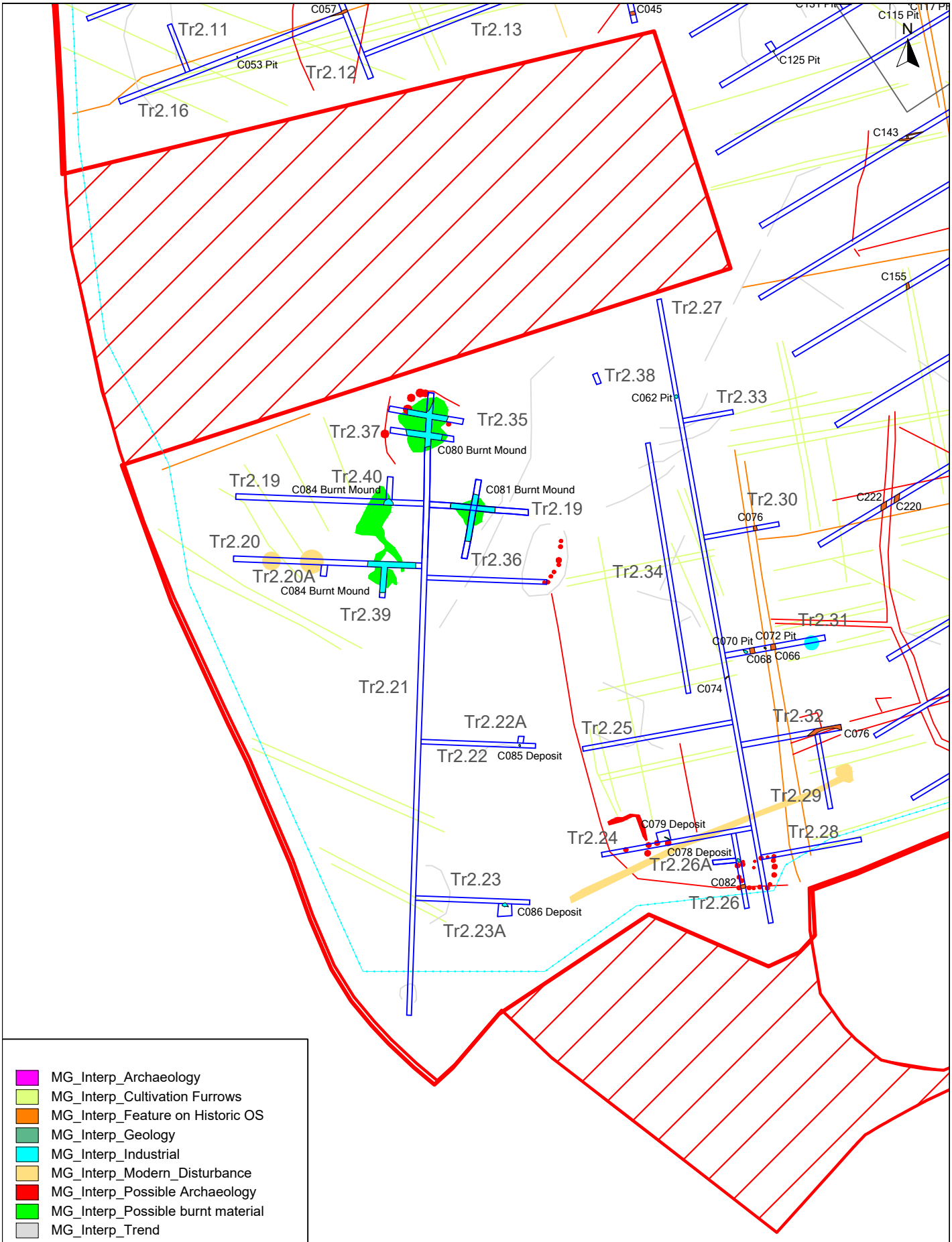
Key:

- Archaeology
- Non-Arc
- Trench
- Fencing
- Site boundary
- Outside area of investi

Fig 9: Close-up of Area 2 (1/2) archaeological testing results overlaid onto the geophysical survey

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2000 @ A4

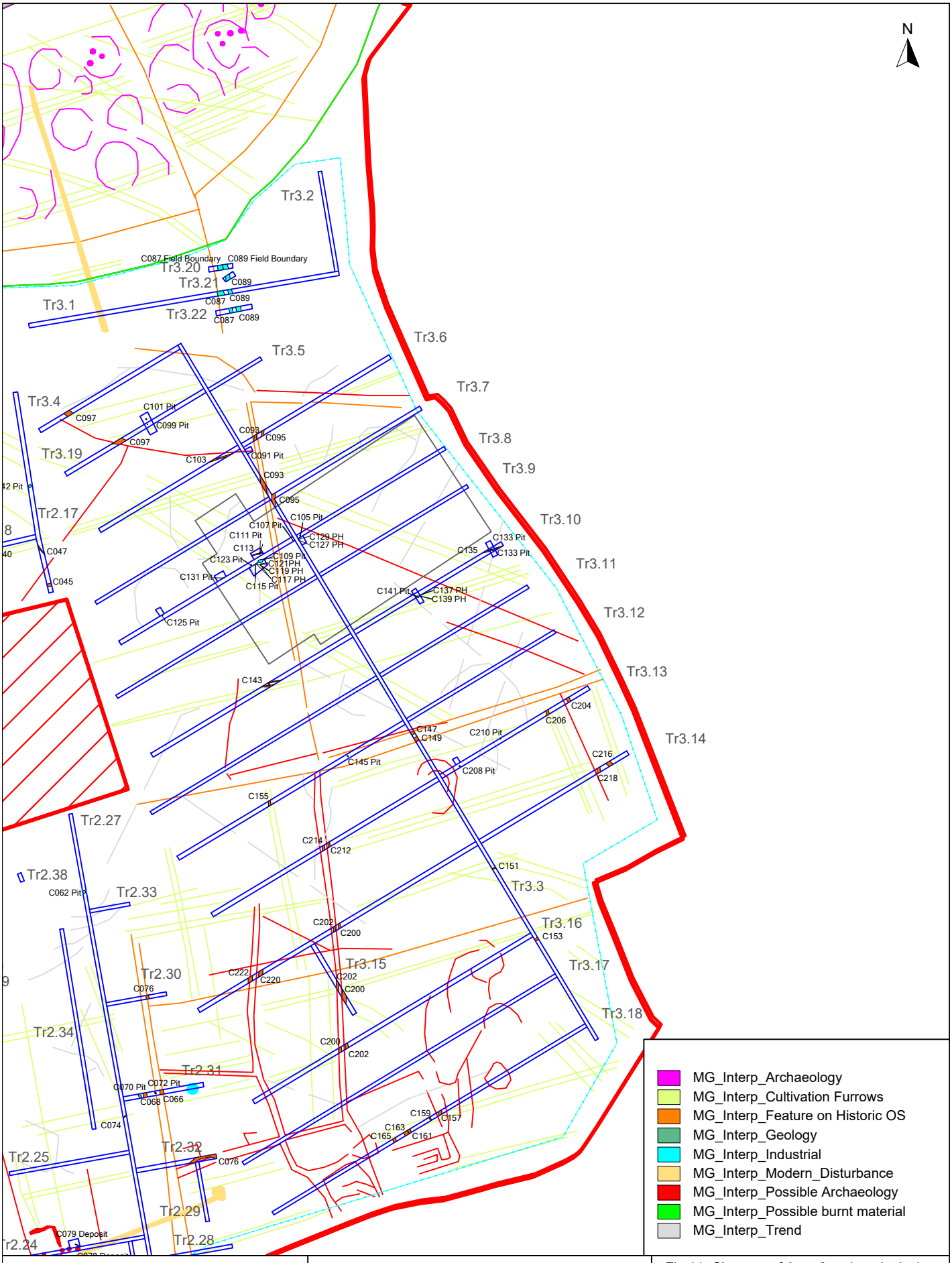
Key:

- Archaeology
- Trench
- Site boundary
- Outside area of investi
- Non-Arc
- Fencing

Fig 10: Close-up of Area 2 (2/2) archaeological testing results overlaid onto the geophysical survey

Created by:	Revision Number:
D. Keane	version 1.0
Approved by:	Date issued:
B.Sutton	09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2500 @ A4

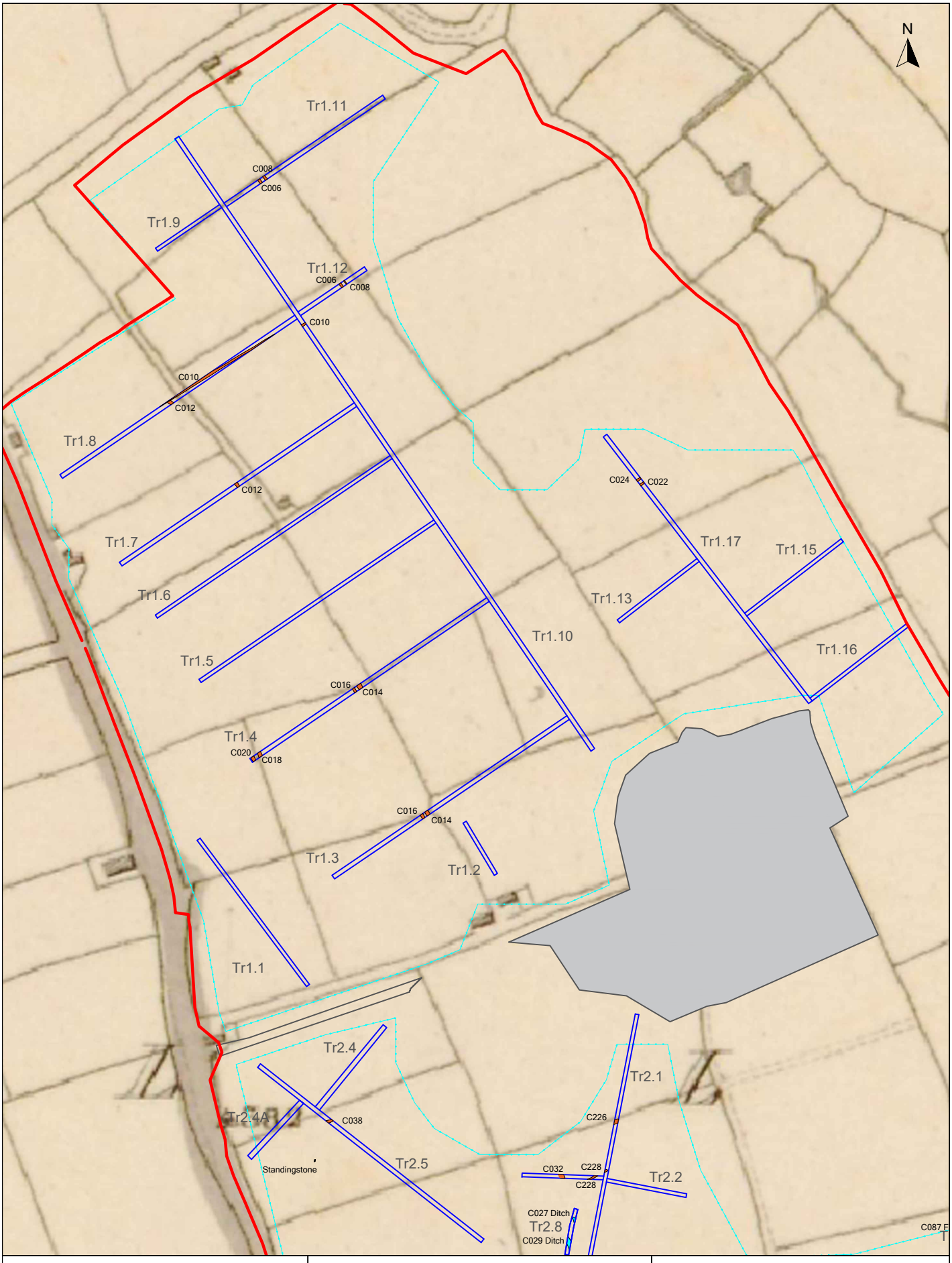
Key:

- Archaeology
- Trench
- Site boundary
- Outside area of investi
- Non-Arc
- Fencing

Fig 11: Close-up of Area 3 archaeological testing results overlaid onto the geophysical survey

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2500 @ A4

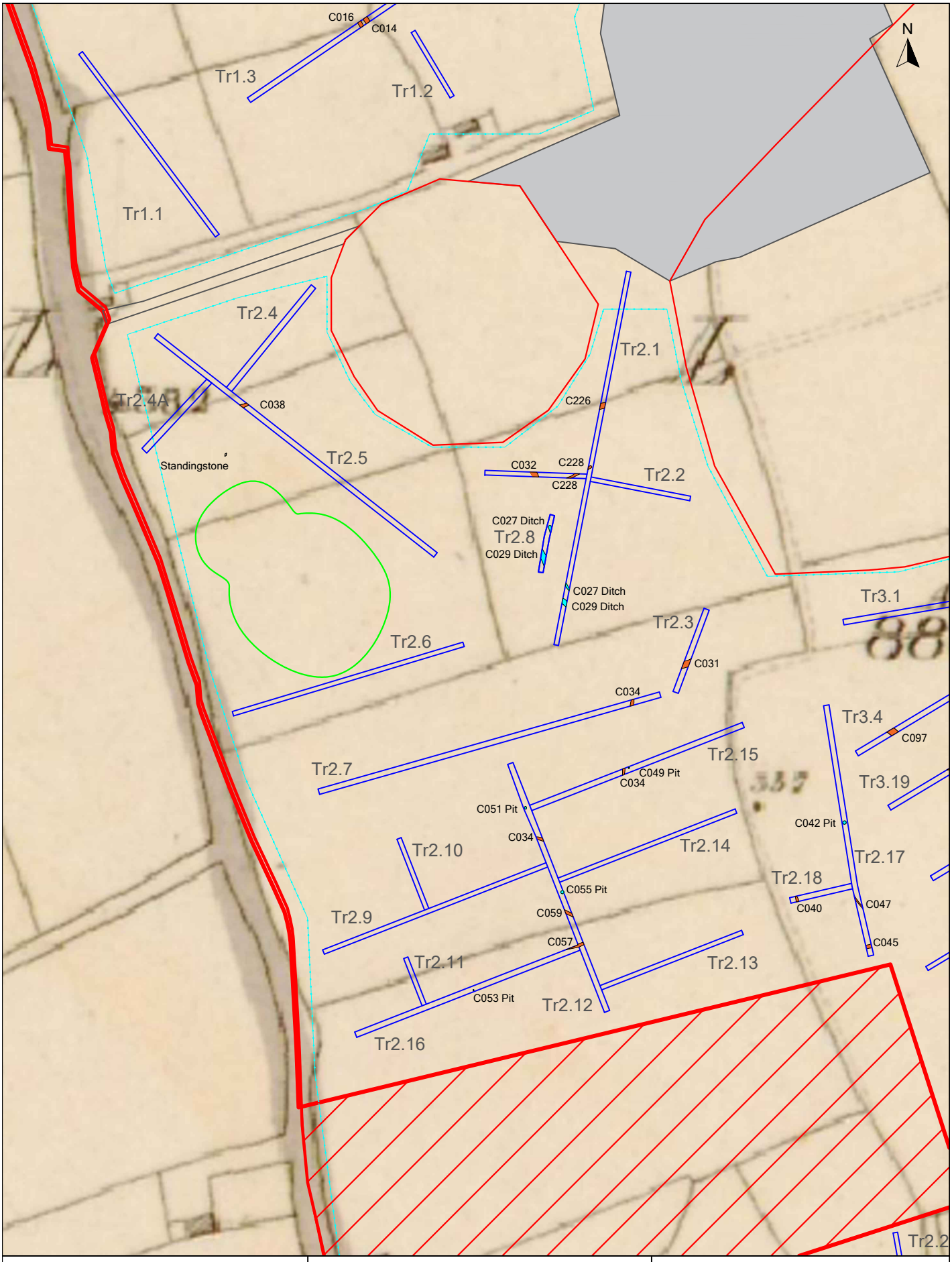
Key:

- Archaeology
- Trench
- Site boundary
- Non-Arc
- Fencing

Fig 12: Close-up of Area 1 Archaeological testing results overlaid onto the 6-inch OSI map of 1845 (Sheet CK086)

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2500 @ A4

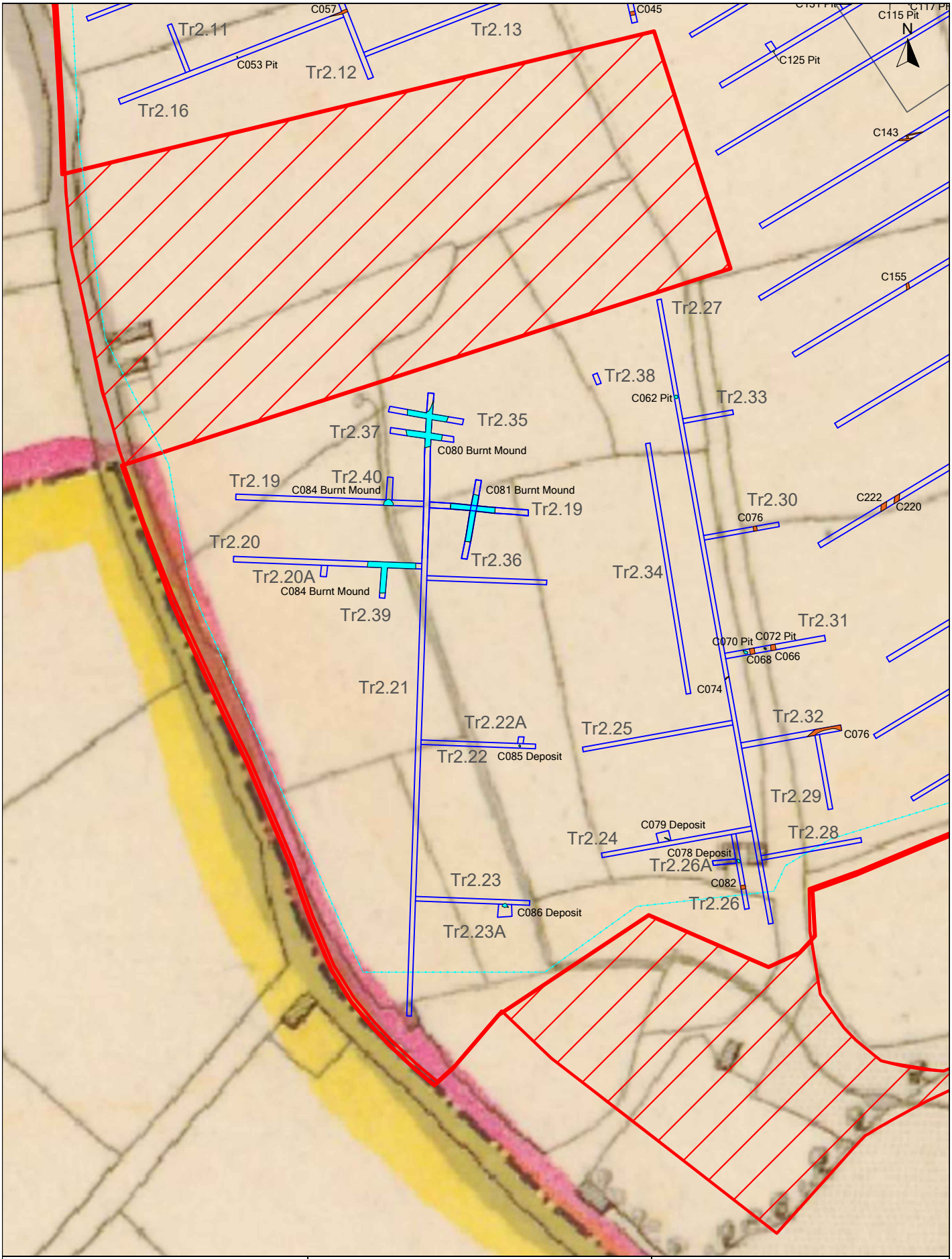
Key:

- Archaeology
- Trench
- Site boundary
- Outside area of investi
- Non-Arc
- Fencing

Fig 13: Close-up of Area 2 (1/2) archaeological testing results overlaid onto the 6-inch OSI map of 1845 (Sheet CK086)

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code:
RH0786

Scale:
1:2000 @ A4

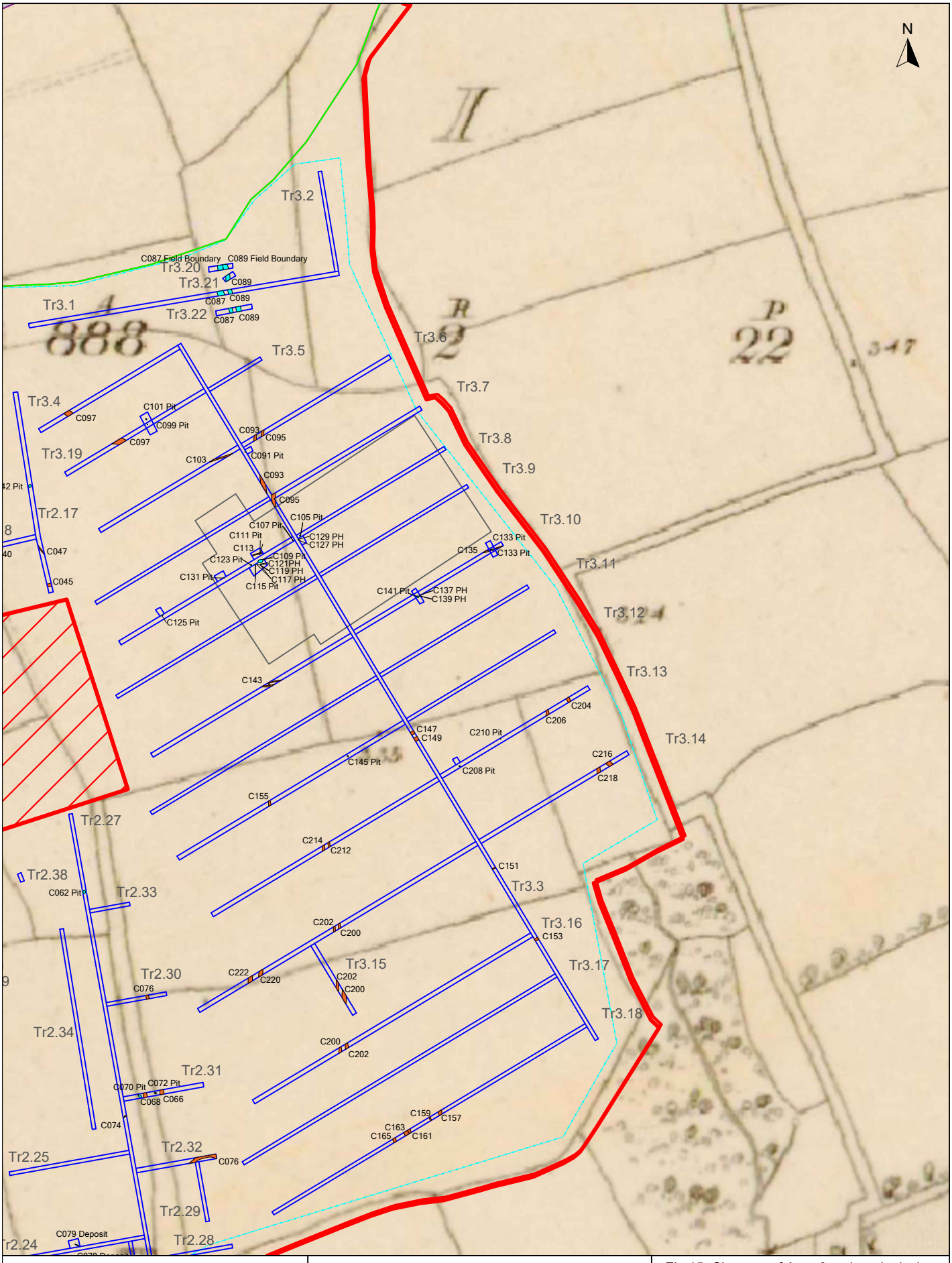
Key:

- Archaeology
- Trench
- Site boundary
- Outside area of investi
- Non-Arc
- Fencing

Fig 14: Close-up of Area 2 (2/2) archaeological testing results overlaid onto the 6-inch OSI map of 1845 (Sheet CK086)

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 100 m



Rubicon Heritage

Project code: RH0786

Scale: 1:2500 @ A4

Key:

- Archaeology
- Trench
- Site boundary
- Outside area of investi
- Non-Arc
- Fencing

Fig 15: Close-up of Area 3 archaeological testing results overlaid onto the 6-inch OSI map of 1845 (Sheet CK086)

Created by: D. Keane	Revision Number: version 1.0
Approved by: B.Sutton	Date issued: 09/11/2023

0 Scale 100 m

APPENDIX 2. Cork County Council issued correspondence

Comhairle Contae Chorcaí
Cork County Council

An Rannóg Pleanála,
Halla an Chontae,
Bóthar Charraig Ruacháin,
Corcaigh T12 R2NC
Fón: (021) 4276891 Faics: (021) 4276321
Suíomh Gréasáin: www.corkcoco.ie
Planning Department,
County Hall,
Carrigrohane Road, Cork T12 R2NC
Tel: (021) 4276891 Fax: (021) 4276321
Web: www.corkcoco.ie
e-mail: - planninginfo@corkcoco.ie

Ballinrea Solar Farm Ltd
C/o Muireann Carroll
McCutcheon Halley
6 Joyce House
Barrack Square
Ballincollig

5th December 2024

Re: Ballinrea Solar Farm Ltd

110kV substation, grid connection and associated infrastructure located at Ballinrea and adjacent townlands Co. Cork.

A chara,

With reference to the above and your submission of the 10th October, you are advised of the following:

This submission relates to Condition 8b, c, d and e only.

(b) The developer shall engage a suitably qualified archaeologist (licensed under the National Monuments Acts) to carry out pre-development archaeological testing in areas of proposed ground disturbance within the greenfield portion of the scheme and to submit an archaeological impact assessment report for the written agreement of the planning authority, following consultation with the National Monuments Service, in advance of any site preparation works or groundworks, including site investigation works/topsoil stripping/ site clearance and/or construction works.

Rubicon Heritage Services Ltd were engaged by the applicant to undertake Archaeological Testing of both the Substation site and the grid connection route.

The **Grid connection** (green field areas only) section of the scheme was tested under licence 24E0662 Ewelina Rondelez in August 2024. Five test trenches were excavated and no finds of significance were identified. I consider the test trenches to be fairly limited in number and size although archaeological monitoring at the construction stage will seek to address any outstanding archaeological issues.

The **substation site** had already been subject to previous testing (Rubicon) under licence 23E0323. The updated PECR report (October 2024, Enda O Flaherty) has specified that a targeted program of archaeological test trenching under license number 23E0323 identified a number of small isolated pits and post holes (CH102) within the footprint of the proposed Ballinrea Substation. The updated PECR and Impact Statement has specified that the proposed substation will have a direct permanent negative effect on any sub-surface remains (Page 29).

The Archaeological Impact Statement, required by Condition 8b is provided in the Table of Impacts on page 30 of the PECR.

Condition 8b is considered to be in compliance.

(c) The report shall include an archaeological impact statement and mitigation strategy. Where archaeological material is shown to be present, avoidance, preservation in-situ, preservation by record [archaeological excavation] and/or monitoring may be required.

The Planning and Environmental Consideration Report has been updated to include the results of the testing of both the substation site and the grid connection route. The PECR (October 2024) has provided Mitigation measures in Section 5 of the report. The mitigation measures are somewhat open ended, however, considering that sub-surface features (isolated pits and posts) have been identified within the substation site (CH102). The archaeologist has proposed that the features identified within the sub-station site (Licence 23E0323) be either preserved in situ and where this is not feasible, preservation by record. The recommendations of the PECR report (page 31, section 5.1. recommends that a mitigation strategy be submitted to the Local Authority archaeologist clearly identifying the preservation strategy for features identified thus far.

Since this element of the scheme has not yet been agreed with the Local Authority by way of a formal compliance submission, this condition is not yet compliant. The applicant is advised to submit a definitive proposal for how the features within the sub-station are to be dealt with.

(d) Any further archaeological mitigation requirements specified by the planning authority, following consultation with the National Monuments Service, shall be complied with by the developer.

As above and the Archaeological Mitigation strategy should include Construction Stage archaeological monitoring in green field areas of the scheme and 'off-road' verges along the cable route and where the scheme passes ZoNs around RMPs and adjacent to the Limekiln (site of) identified in the testing report 24E0662 (grid connection route). Further agreements may have to be made regarding how any further/ new features are dealt with (either preservation in site or preservation by record).

(e) No site preparation and/or construction works shall be carried out on site until the

archaeologist's report has been submitted to and approval to proceed is agreed in writing with the planning authority.

Although the 'archaeologist's report' (assumed in Condition 8 to refer to the 'Testing report'), has been submitted, approval to proceed in writing cannot be progressed in green areas until Condition 8c and d are finalised and agreed. Other advance conditions also apply prior to construction (Exclusions zones, CEMPs etc).

Is mise le meas,

Gillian Kelleher
Gillian Kelleher
Planning Department

Appendix 6: Drainage Report

DOSA
DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS

BALLINREA 110KV SUBSTATION & GRID CONNECTION, BALLINREA, CARRIGALINE, CO. CORK

DRAINAGE AND WASTEWATER DESIGN REPORT

DATE 21/01/2025

REVISION 0

JOB NO. 6981

Joyce House, Barrack Square, Ballincollig, Co. Cork
T 021 4871781 F 021 4874157 info@dosa.ie www.dosa.ie

DOCUMENT CONTROL

PROJECT NAME: Ballinrea 110KV Substation & Grid Connection, Ballinrea, Carrigaline, Co. Cork

PROJECT NUMBER: 6981

REVISION	DATE	FILE NAME: Drainage and Wastewater Design Report			
0	21.01.2025	DESCRIPTION: Issued for Precedent Conditions Submittal			
			PREPARED	CHECKED	APPROVED
		INITIAL	MC	MC	LO'T
		DATE	21.01.2025	21.01.2025	21.01.2025
	Insert Date	FILE NAME:			
		DESCRIPTION:			
			PREPARED	CHECKED	APPROVED
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		DATE	Insert Date		Insert Date
	Insert Date	FILE NAME:			
		DESCRIPTION:			
			PREPARED	CHECKED	APPROVED
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		DATE	Insert Date	Insert Date	Insert Date
		FILE NAME:			
		DESCRIPTION:			
			PREPARED	CHECKED	APPROVED
		INITIAL			
		DATE	Insert Date	Insert Date	Insert Date

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1.2 Site Location 1

2 Stormwater Drainage Regime 4

2.1 Existing Regime Within Ballinrea Solar farm 4

2.2 Surface Water Drainage Strategy for Proposed Substation Development 5

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Appendix A –Drawings

Appendix B – IPP Building Soakaway Design

Appendix C – Eirgrid Building Soakaway Design

Appendix D – Rainwater Harvesting Tank Details

Appendix E – Bypass Separator Details

Appendix F – Stormtech Details

Appendix G – Foul Sewer Holding Tank Details

1 General

1.1 Introduction

Denis O'Sullivan & Associates (DOSA), Consulting Engineers were commissioned by Ballinrea Solar Farm Ltd to compile a response to planning conditions 9 and 10 of the granted permission, by An Bord Pleanála under order number ABP-317706-23, for the Proposed development of a 110kV substation, grid connection and associated infrastructure located at Ballinrea and adjacent townlands, co Cork. Conditions 9 and 10 deal with the foul and storm water on the site.

Condition 9:

Drainage arrangements, including the attenuation and disposal of surface water, shall comply with the requirements of the planning authority for such works and services. Details to be agreed with the planning authority prior to commencement of development.

Condition 10:

An underground sealed wastewater holding tank shall be installed on site with effluent to be removed to a licensed wastewater treatment facility for treatment and disposal at regular intervals. Details of the holding tank shall be submitted for the agreement of the planning authority prior to the commencement of development.

The appointed contractor will ensure that the following detailed design development will be carried out in compliance with the planning conditions and the measures set out in this report as well as the Construction and Environmental Management Plan (CEMP).

1.2 Site Location

The Ballinrea 110kV substation and compound is located within the Ballinrea Solar Farm Site, which is located 2.7km northwest of Carrigaline Town Centre at a settlement known as Ballinrea. The site also includes the grid connection route to the national grid. Figure 1 below shows the entire development. MKO drawing number 211231-c-03 is also included in Appendix A which outlines the entire site. The solar farm substation site comprises of agricultural grasslands and is located within the approved Ballinrea Solar farm development. The substation site is accessed via an existing entrance from the local road L-2464. The L-2464 then connects to the L-2473 which joins the R611 before joining the N28 Cork to Ringaskiddy Road.

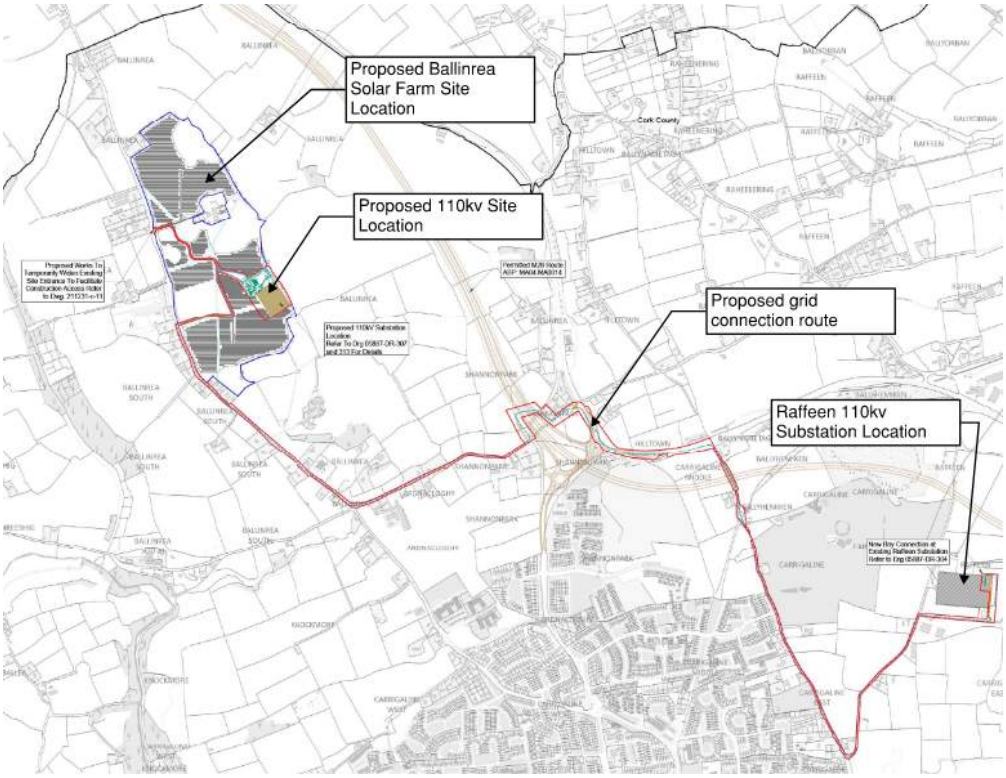


Figure 1.0: – Ballinrea Solar Farm, 110kV Substation and Grid Connection route[1]

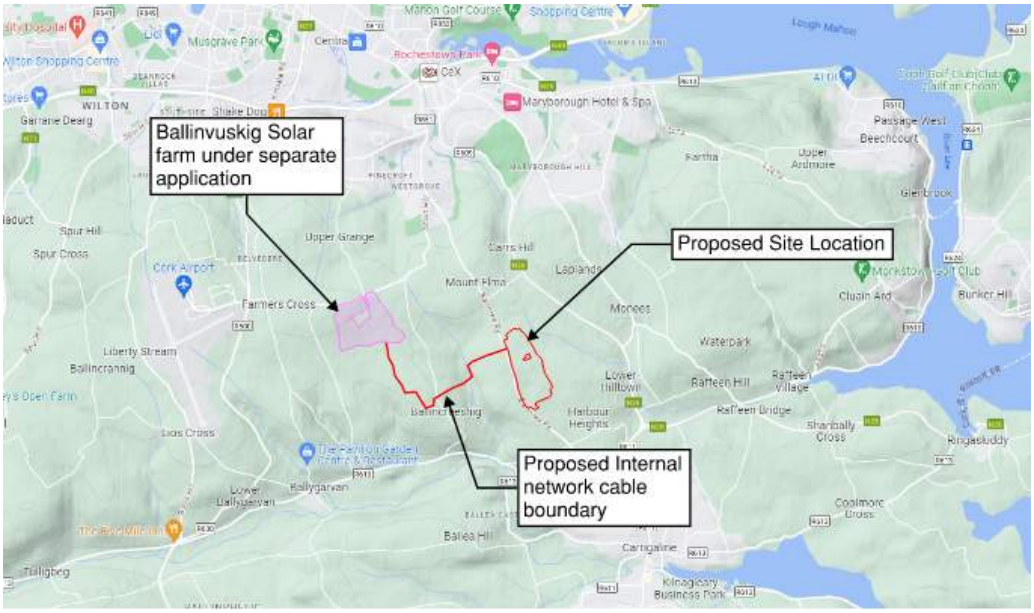


Figure 1.1: Proposed Solar Farm Development Location[2]

The land around the solar farms and the proposed 110kV Substation are free draining to ground. No land drains are recorded within the site, and no drainage issues were noted during the site visit. An overview of the regional drainage network is outlined in Figure 1-2 below while the local drainage network is presented in Figure 1. 3 of this report.

[1] Extract from MKO drawing 211231-c-03
[2] Map sourced from google maps.

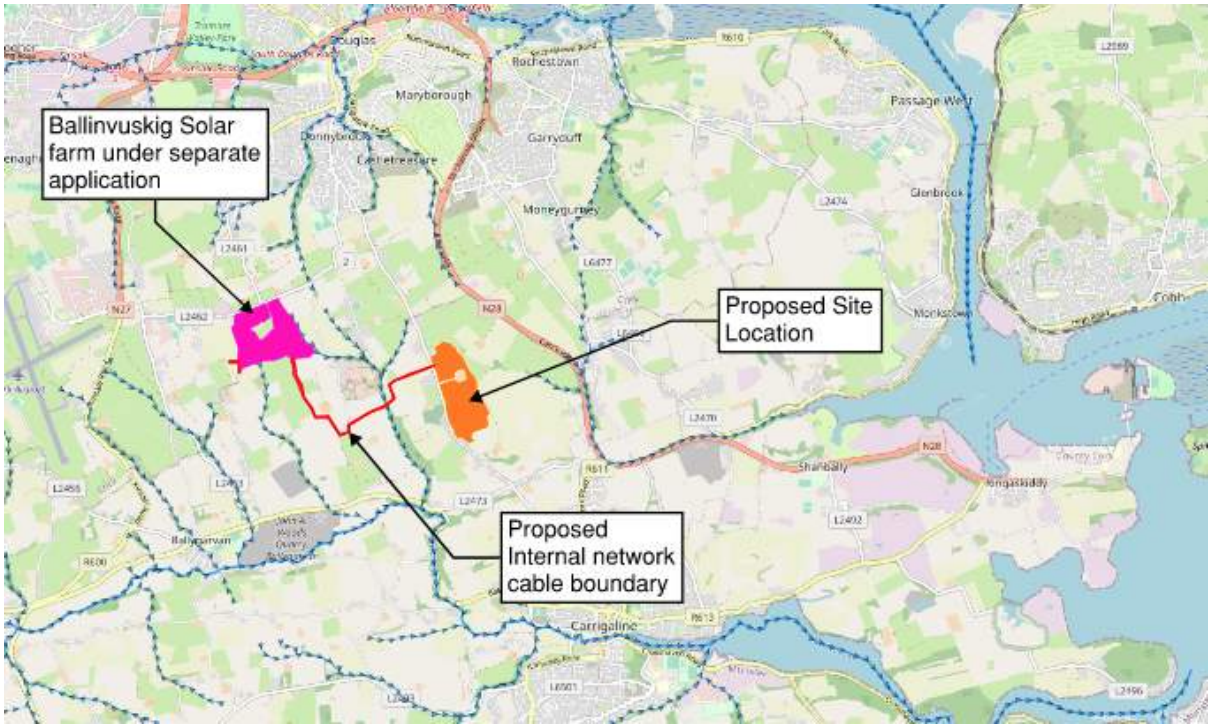


***Figure 1.1**: Reginal Drainage Network*[3]

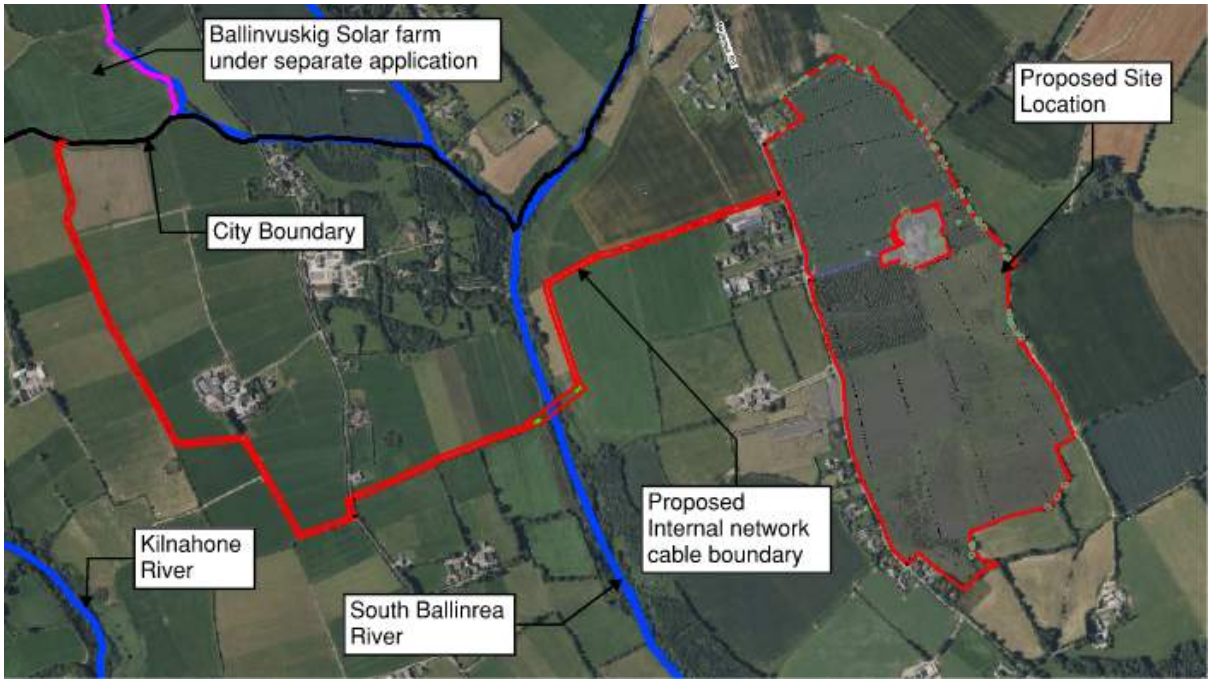


***Figure 1.2**: Local Drainage Network*[4]

[3] Map sourced from https://gis.epa.ie/EPAMaps/
[4] Map sourced from www.epa.ie

2 *Stormwater Drainage Regime*

2.1 Existing Regime Within Ballinrea Solar farm

The existing surface water regime on the site is that any rainwater percolates to the ground. As shown in figure 1 of this report there are no water courses running through the site. Figure 2.1 below shows the existing drainage regime for the Ballinrea Solar Farm site which will be the same for the substation site located within the middle of the site.

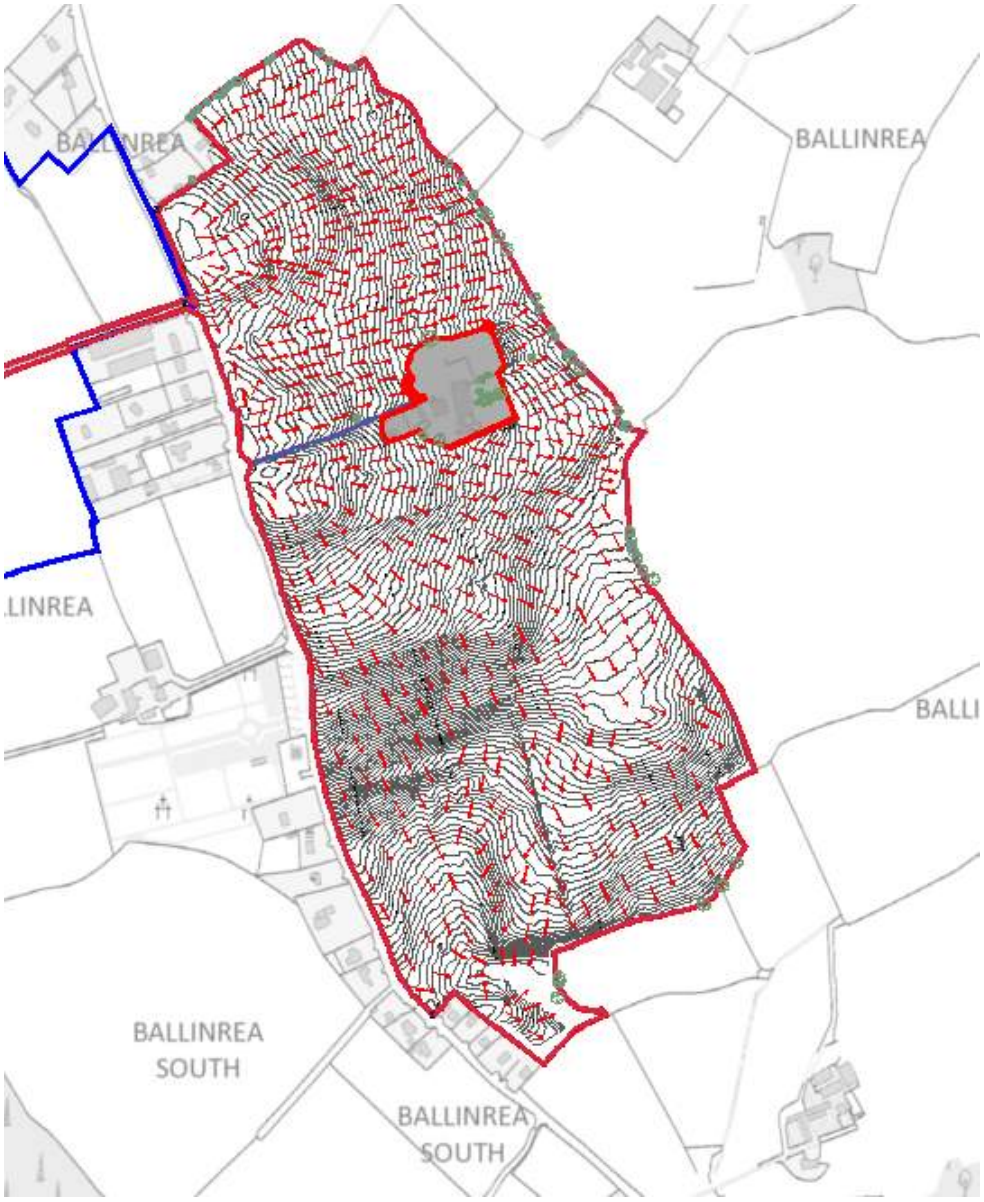


Figure 2.1: Existing Drainage Regime at the Ballinrea Solar Farm site.

2.2 Surface Water Drainage Strategy for Proposed Substation Development

There proposed substation site will be divided into two sites each under separate occupancy. The Ballinrea 110kV substation will be made up of a control building, switchgear building, transformer compound and busbar compound. Each site will also have independent storm water drainage. Where possible Surface-water run-off will continue to be accommodated by the existing infiltration pattern of the site using permeable materials for surfaces such as loose stone and grassed areas. Where hard surfaces exist as part of the internal roads of the compounds, footpaths and substation roof, a drainage network will be constructed which will implement rainwater harvesting for run off from the roof of the building along with the design of a bypass separator and a soakaway to allow run off percolate back into the ground. Drawing 6981-0020 shows the proposed drainage layout for the substation site and is included in Appendix A of this report.

The access roads through the solar farm to the substation site will be constructed from permeable materials and so no additional drainage is proposed for the access tracks. Figure 2.2 below shows a section through the proposed access tracks.

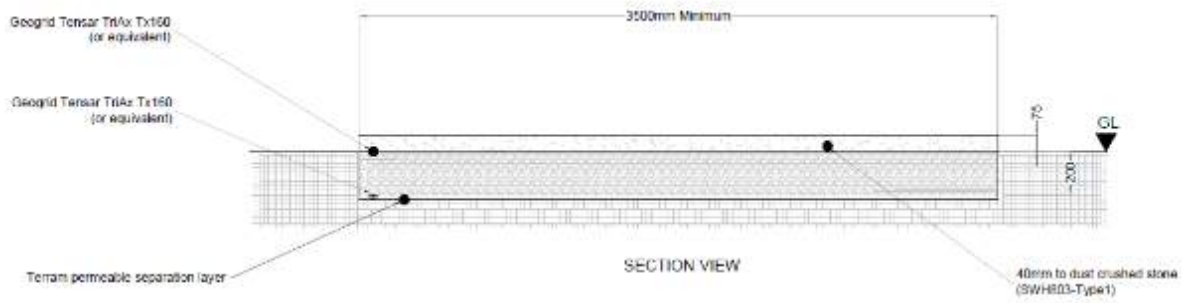


Figure 2.0: Section through the proposed access tracks

The proposed grid connection is along existing public roads. These roads have existing storm water drainage. The installation of the grid connection along these roads will not alter the existing drainage regime of the roads. The grid connection works will be carried out in accordance with the mitigation measures as set out in the CEMP.

2.2.1 Storm water Drainage Design

The storm water drainage for the substation site is designed to cater for a 1 in 100-year storm event and for 10% climate change. The soakaway has been designed to BRE Digest 365 and is designed to be half empty within 10 hours

2.2.1.1 IPP Substation

The IPP substation site has a total hard surface area of 970m^2. This area includes the roads, footpaths and the large transformer plinth. The roof runoff is diverted into a rainwater harvesting tank. This tank is sized to hold 1,500 litres of rainwater which can be used as grey water within the substation building. Details of the rainwater harvesting tank are included in Appendix D of this report. The runoff from the remainder of the hardstanding's will be gathered by way of road gullies and conveyed to the bypass separator to remove any hydrocarbons before entering the soakaway. Details of the bypass separator are included in Appendix E of this report.

The soakaway has been designed to cater for the runoff from a 1 in 100-year storm event and will percolate to the ground. The design of the soakaway is included in Appendix B of this report. The soakaway will be constructed from stormtech chambers with a clean crushed stone surround and wrapped in a non-woven geotextile. Details can be seen in Figure 2.1 below. The soakaway will have a storage capacity of 97.2m^3.

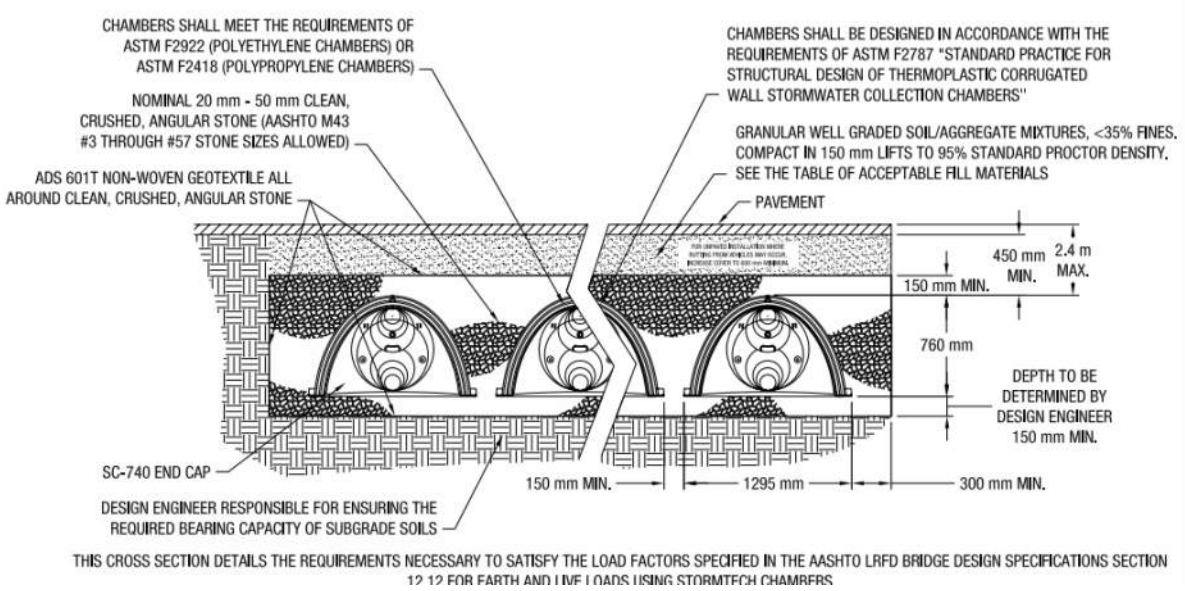


Figure 2.1: Proposed Stormtech Details for Soakaway.

2.2.1.2 Eirgrid Substation

The Eirgrid substation site has a total hard surface area of 1004m^2. This area includes the roads, and footpaths around the site. The roof runoff is diverted into a rainwater harvesting tank. This tank is sized to hold 1,500 litres of rainwater which can be used as grey water within the substation building. Details of the rainwater harvesting tank are included in Appendix D of this report. The runoff from the remainder of the hardstanding's will be gathered by way of road gullies and conveyed to the bypass separator to remove any hydrocarbons before entering the soakaway. Details of the bypass separator are included in Appendix E of this report.

The soakaway has been designed to cater for the runoff from a 1 in 100-year storm event and will percolate to the ground. The design of the soakaway is included in Appendix B of this report. The soakaway will be constructed from stormtech chambers with a clean crushed stone surround and wrapped in a non-woven geotextile. Details can be seen in Figure 2.1. The soakaway will have a storage capacity of 97.2m^3. Details of the Stormtech chambers can be found in Appendix F of this report.

3 Foul Drainage Design

This design proposes is to discharge all foul water generated by the proposed substation buildings to on-site holding tanks. These tanks are designed to cater for the required volumes created form the buildings. The following design has been carried out, in accordance with Irish Water requirements, to size the tanks. The tank for the Eirgrid and IPP substations will be the same size tanks as there is only one WC provided in each building.

From Irish Water Code of Practice for Wastewater Infrastructure - Appendix D - Wastewater Flow Rates for Design

- Amenity sites = 10 litres/toilet/use.

There will be an average of 2 people in the building per day and they may need to use the toilet 5 times a day (conservative) which would be total of (2)(5) = 10 uses a day

Dry Weather Flow (DWF)= (5) (10) = 50 litres/Day = 0.0017 l/s for an 8-hour day.

Total outflow from each substation building = 0.0017 l/s

6 DWF = (6) (0.0017) = 0.0102 l/s

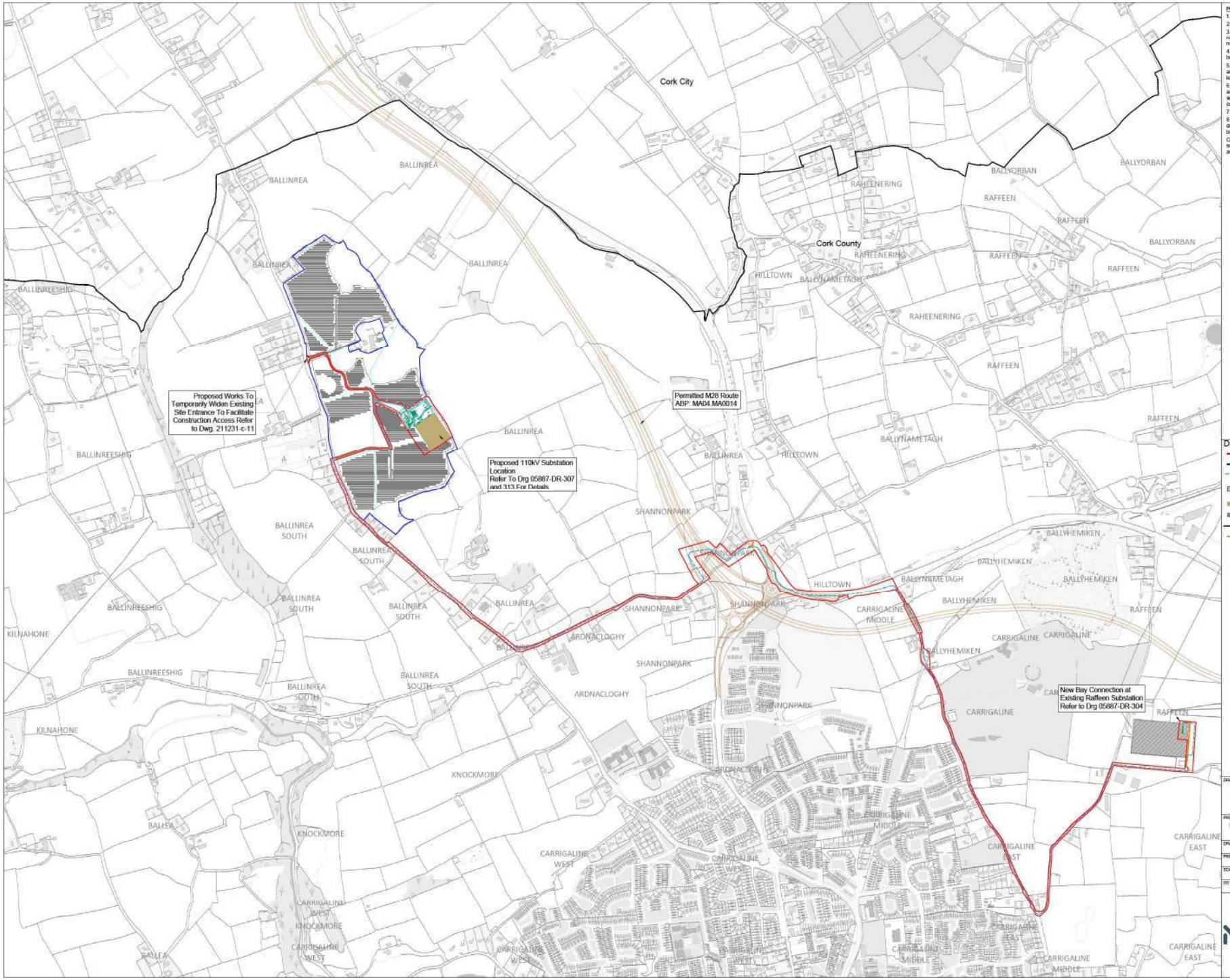
The proposed storage tank has a total capacity of 6.9 cubic meters of storage. With a flow rate of 50 l/day that would provide 138 days storage.

It should be noted that the above figures are conservative for an ESB Substation site as these sites are not maned on a daily basis and are monitored remotely. There are only staff on site when there is maintenance works required. As a result the toilets will be programmed to flush automatically every 5 days to prevent the traps from drying out leading to odours coming back into the building.

The foul wastewater discharge from the site will be held in a holding tank and will be taken away by truck to a wastewater facility when the holding tank is full.

Details of the proposed foul water storage tank for each site is in cluded in Appednix G of this report.

Appendix A –Drawings



Project Design Drawing Notes

1. Drawings issued are for planning application purposes only.
2. Drawings not to be used for construction/contract conditions.
3. Copyright, all rights reserved. No part herewith may be copied or reproduced partially or wholly in any form whatsoever without the prior notice of the copyright owner McCarthy Keville O'Sullivan.
4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Final levels may vary depending on local ground conditions.
8. Path of cable route and location of associated joint bays may vary depending on site conditions. Deviations will remain within the planning boundary at all times.

Other services may be encountered along the route. Where such services are encounter and require relocation, this will be carried out in an appropriate manner within proximity to its location.

N

Drawing Legend

- Planning Application Boundary
- Landowner Boundary
- Underground Grid Connection
- Existing Raffeen 220kV Substation Refer To Drg 05887 DR 303 For Layout
- Temporary Construction Compound
- Ballinrea Solar Park Proposed Infrastructure (Pl Ref No: 23/4563)
- County Boundary
- Permitted M28 Route (ABP: MA04.MA0014)

Ordnance Survey Ireland Licence No. CYAL50087517© Ordnance Survey Ireland/Government of Ireland

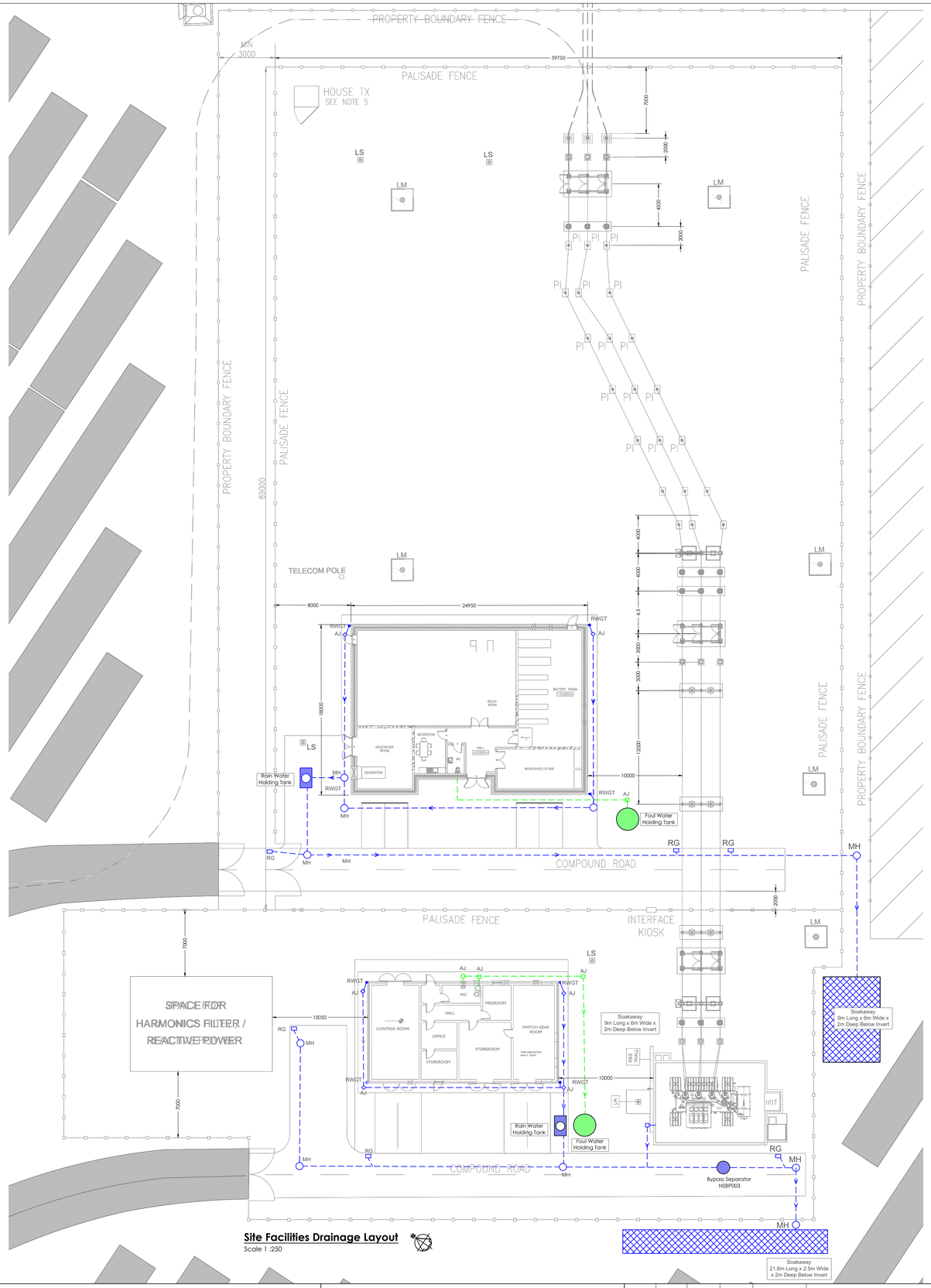
DRAWING TITLE:

Site Layout Overview

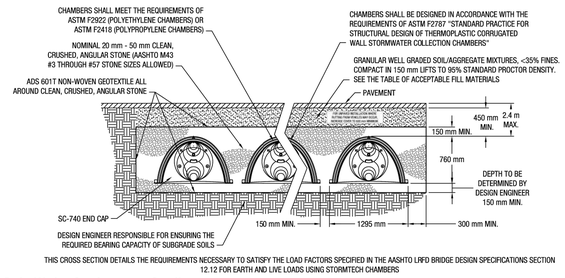
PROJECT TITLE:
Ballinrea 110kV Substation and Grid Connection Strategic Infrastructure Development

DRAWING BY: KD	CHECKED BY: JW
PROJECT No: 211231-c	DRAWING No: 211231-c-03
SCALE: 1:10,000@ A2	DATE: 25.07.2023
OS SHEET No.: 6470, 6471, 6509, 6510	

MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
email: info@www.mkoireland.ie
Website: www.mkoireland.ie

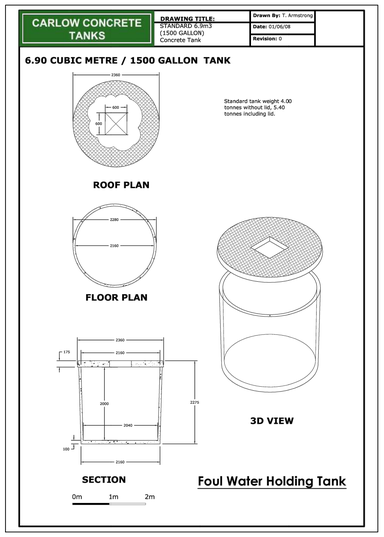


Site Facilities Drainage Layout
Scale 1 :250

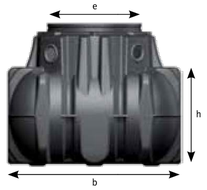


THIS CROSS SECTION DETAILS THE REQUIREMENTS NECESSARY TO SATISFY THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS USING STORMTECH CHAMBERS

Rain Water Soakaway - Section



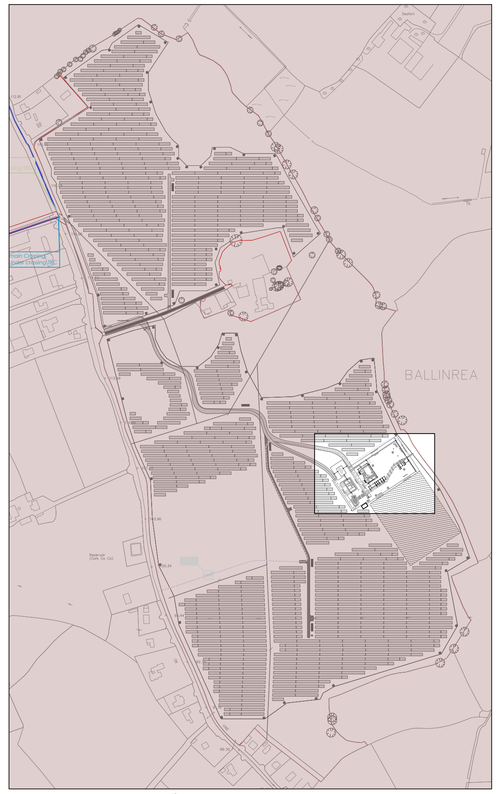
Dimensions/weight	1,500 litres
Length (l)	2,100mm
Width (w)	1,250mm
Height of tank shoulder (h)	700mm
Height of dome collar (hd)	315mm
Ø inlet (e)	650mm
Ø tank dome (d)	800mm
Weight approx.	80kg



Rain Water Holding Tank



Bypass Separator – NSBP003



Site Layout - Key Plan
Scale 1 :5000

Legend
- Storm/Rain Water Pipes
- Rain Water Holding Tank
- Foul Water Pipes
- Foul Water Holding Tank

Joyce House
Barrack Square
Ballincollig
Cork
P31 KP84

021 4871781
info@dosa.ie
www.dosa.ie

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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
A	G.S.	M.C.	M.C.	16.10.24	Issued for Information

CLIENT: Ballinrea Solar Farm Limited

PROJECT: Ballinrea Solar Farm, Carrigaline, Co Cork

DRAWING TITLE: Site Facilities Drainage Layout

SHEET: A1

SCALE: 1:250

PROJECT NO. 6981 _ DRAWING NO. 0020 _ STATUS/ISSUE A

Appendix B – IPP Building Soakaway Design

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **960.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.220**
5-year return period rainfall of 60 minutes duration	M5_60min = **30.1** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **10** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **2000** mm
Width of pit	w = **6000** mm
Length of pit	l = **9000** mm
Percentage free volume	V_{free} = **90** %
Soil infiltration rate	f = **44.0×10^{-6}** m/s
Wetted area of pit 50% full	$a_{s50} = l \times d + w \times d$ = **30000000** mm^2

Table equations

Inflow (cl.3.3.1)	$I = M100 \times A$
Outflow (cl.3.3.2)	$O = a_{s50} \times f \times D$
Storage (cl.3.3.3)	$S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.30;	9.8;	1.91;	18.7;	17.97;	0.40;	17.57
10	0.44;	14.6;	1.98;	28.9;	27.73;	0.79;	26.94
15	0.55;	18.1;	2.01;	36.5;	35.01;	1.19;	33.82
30	0.74;	24.4;	2.01;	49.1;	47.12;	2.38;	44.75
60	1.00;	33.1;	1.95;	64.4;	61.83;	4.75;	57.07
120	1.32;	43.7;	1.86;	81.3;	78.06;	9.50;	68.55
240	1.75;	57.9;	1.76;	101.7;	97.68;	19.01;	78.67
360	2.14;	70.9;	1.67;	118.2;	113.47;	28.51;	84.96
600	2.55;	84.3;	1.60;	135.1;	129.74;	47.52;	82.22
1440	3.52;	116.4;	1.51;	175.9;	168.83;	114.05;	54.79

Required storage volume	S_{req} = **84.96** m^3
Soakaway storage volume	$S_{act} = l \times d \times w \times V_{free}$ = **97.20** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume	$t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 8hr 56min 22s

PASS - Soakaway discharge time less than or equal to 24 hours

Appendix C – Eirgrid Building Soakaway Design

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Other
Impermeable area drained to the system	A = **1004.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.220**
5-year return period rainfall of 60 minutes duration	M5_60min = **30.1** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **10** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **2000** mm
Width of pit	w = **6000** mm
Length of pit	l = **9000** mm
Percentage free volume	V_{free} = **90** %
Soil infiltration rate	f = **44.0×10^{-6}** m/s
Wetted area of pit 50% full	$a_{s50} = l \times d + w \times d$ = **30000000** mm^2

Table equations

Inflow (cl.3.3.1)	$I = M100 \times A$
Outflow (cl.3.3.2)	$O = a_{s50} \times f \times D$
Storage (cl.3.3.3)	$S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.30;	9.8;	1.91;	18.7;	18.79;	0.40;	18.40
10	0.44;	14.6;	1.98;	28.9;	29.01;	0.79;	28.21
15	0.55;	18.1;	2.01;	36.5;	36.61;	1.19;	35.43
30	0.74;	24.4;	2.01;	49.1;	49.28;	2.38;	46.91
60	1.00;	33.1;	1.95;	64.4;	64.66;	4.75;	59.91
120	1.32;	43.7;	1.86;	81.3;	81.63;	9.50;	72.13
240	1.75;	57.9;	1.76;	101.7;	102.15;	19.01;	83.15
360	2.14;	70.9;	1.67;	118.2;	118.67;	28.51;	90.16
600	2.55;	84.3;	1.60;	135.1;	135.68;	47.52;	88.16
1440	3.52;	116.4;	1.51;	175.9;	176.57;	114.05;	62.52

Required storage volume: S_{req} = **90.16** m^3

Soakaway storage volume: $S_{act} = l \times d \times w \times V_{free}$ = **97.20** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume: $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 9hr 29min 12s

PASS - Soakaway discharge time less than or equal to 24 hours

Appendix D – Rainwater Harvesting Tank Details

Rainwater harvesting solutions

THE PLATIN® FLAT TANK SYSTEM



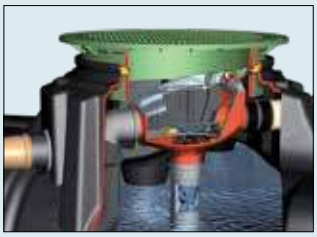
Welcome to GRAF

Save up to 50% of your mains water needs - with GRAF's complete packages!



It's also very straight-forward and easy to do. Put simply, rainwater harvesting is collecting the rainwater that falls onto the roof of a building (either a home or a commercial building) and then capturing it inside a tank, which can be located either above or below ground. On it's way into the tank, it passes through a filter – which varies in size depending on the surface area of the roof that the rainwater is being collected from – which keeps all leaves, moss and debris that may be travelling with the rainwater out of the tank. Once the rainwater is held within the tank, it is then extracted for use. If the rainwater tank is above ground, then the rainwater can simply be taken out of the tank via a tap – as would be the case in a simple water butt. If the rainwater is being stored in a tank underground, then it must be extracted out of the tank using a pump. There are many types of pumps for different applications. Depending on what the harvested rainwater is being used for, there may also be a requirement for a mains water backup function for periods where little rainwater is collected.

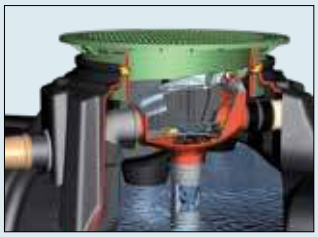
Four-stage cleaning process for best water quality



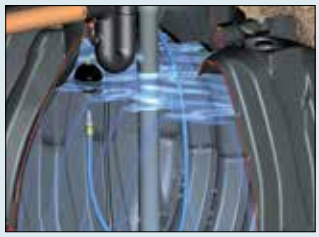
Stage 1
First the rainwater is cleaned by a patented filter system. The cleaned water flows into the tank and dirt particles are rinsed into the sewer system along with a small amount of residual water.



Stage 2
To allow very fine dirt particles to settle, the filtered water is routed through a steady inflow pot on the base of the tank. This prevents the water from being stirred up and also adds oxygen to the water at the bottom of the tank. This keeps the water clear and fresh.



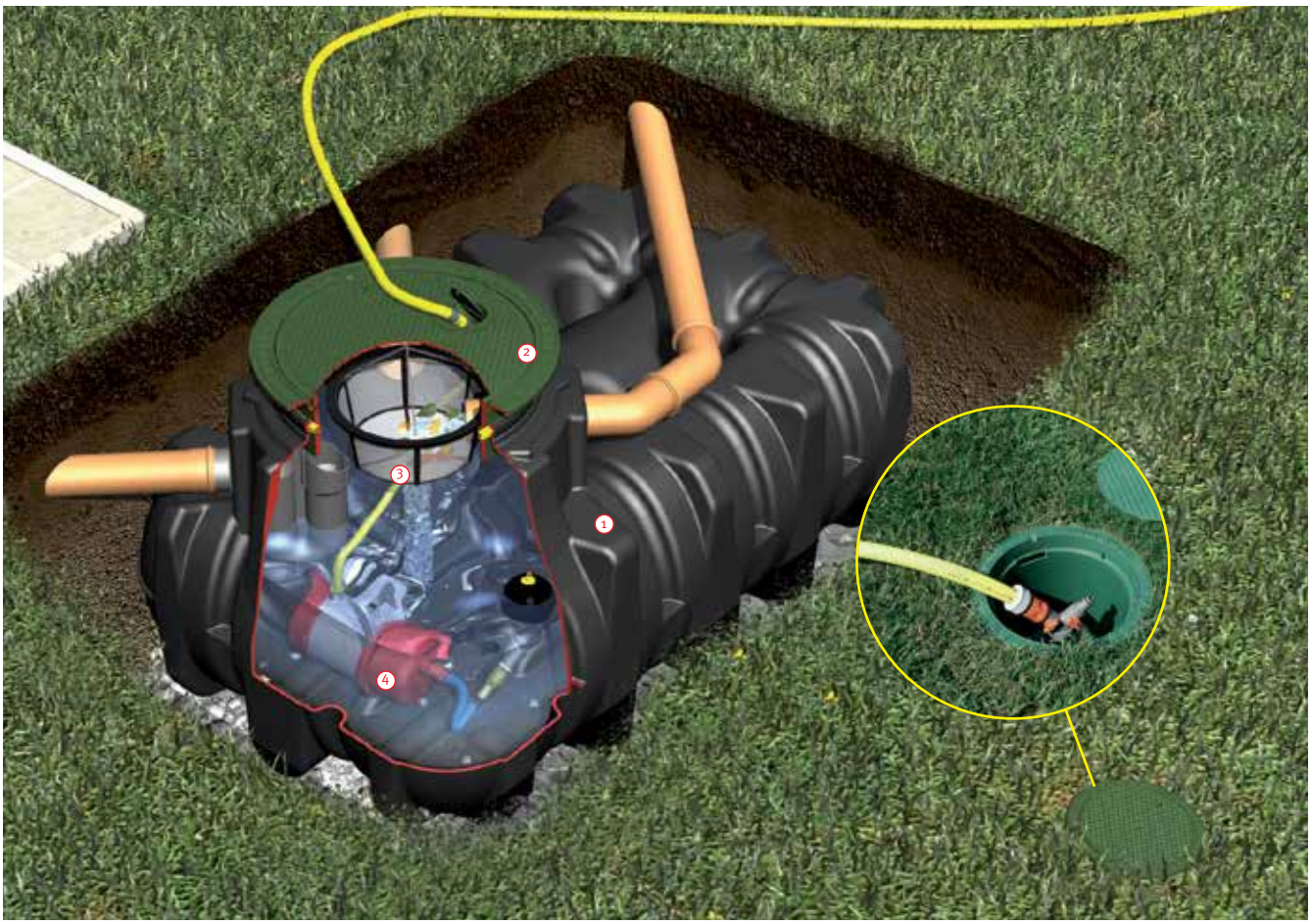
Stage 3
Particles that are lighter than water (such as pollen) from a floating layer on the surface. The overflow siphon installed in the tank causes the floating layer to be removed when the tank overflows. So it's important to let the tank overflow regularly to ensure consistent water quality.



Stage 4
The collected rainwater is removed by means of a floating extraction unit near the top of the tank. The best water quality is found around 10 cm (4") below the water's surface.

Platin® Garden Comfort package

Save up to 50% of your mains water needs - with GRAF's complete packages!



Platin Garden Comfort package

- Draw water from the socket like electricity
- Simple installation thanks to integrated filter technology
- Water can be extracted using an internal water connection box for standard watering system
- Easy to assemble due to modular components
- Just one cover visible at the surface

Scope of supply

① Platin® flat tank incl. 4 prefitted DN 100 lip seals

② Tank cover suitable for pedestrian or vehicle loading depending on the version

③ Tank filter package for the garden consisting of:
- Internal filter basket incl. suspension
- Overflow siphon with integrated rodent guard

④ Garden-Comfort technical package consisting of:
- Integra INOX stainless steel submersible and suction pump incl. floating extraction setup
- 10m pressure hose 1"
- Internal water connection box
- External water connection box

Capacity/litres	US gallons
1,500	400
3,000	800
5,000	1,350
7,500	1,980

Vehicle loading version available

Platin® ECO-Plus package

Save up to 50% of your mains water needs - with GRAF's complete packages!



Platin ECO-Plus House package

- Self-cleaning integrated filter technology
- Mains water intake controlled by floating switch as required
- Easy to assemble due to modular components
- Just one cover visible at the surface

Scope of supply

① Platin flat tank incl. 4 pre-fitted DN 100 lip seals

② Tank cover suitable for pedestrian or vehicle loading depending on the version

③ Tank filter package for the house consisting of:
- Minimax internal filter (self-cleaning)
- Steady inlet pot and overflow siphon
- Spannfix pipe connection sleeve

④ ECO-Plus technical package consisting of:
- Mains water feeding console 15/4
- Floating switch extraction
- Wall duct DN 100
- Labelling set
- Suction pipe 25m Black & Green labelled RAINWATER

Capacity/litres	US gallons
1,500	400
3,000	800
5,000	1,350
7,500	1,980

Vehicle loading version available

Platin® House Indirect-supply package

The reliable domestic solution with submersible pump and header tank system



Platin House Indirect-supply package

- Simple & quick to install
- Submersible pump supplies harvested rainwater on demand to the header tank where it is then gravity-fed to the WCs & washing machine
- The header tank controls the operation of the system and the supply of harvested rainwater and backup mains water to the WCs
- Dual valve system within the header tank prioritises rainwater supply over mains water, maximising the use of all available rainwater to save on mains water consumption
- Mains water switchover point is at a lower level in the header tank when rainwater is not available from the underground Platin tank
- Mains water backup supply is not reliant on power supply or pump pressure and therefore guarantees supply of water to WCs at all times

Scope of supply

① Underground tank (choice of tanks available, sizes vary according to property type)

② Telescopic lid (choice of telescopic lid available, depending on tank location)

③ Minimax filter supplied in accordance with type of tank

④ Submersible pump with floating water intake

⑤ Float switch (connected from mains water backup unit to the underground tank)

⑥ 100mm diameter duct pipe to contain; float sensor cable, power cable for pump

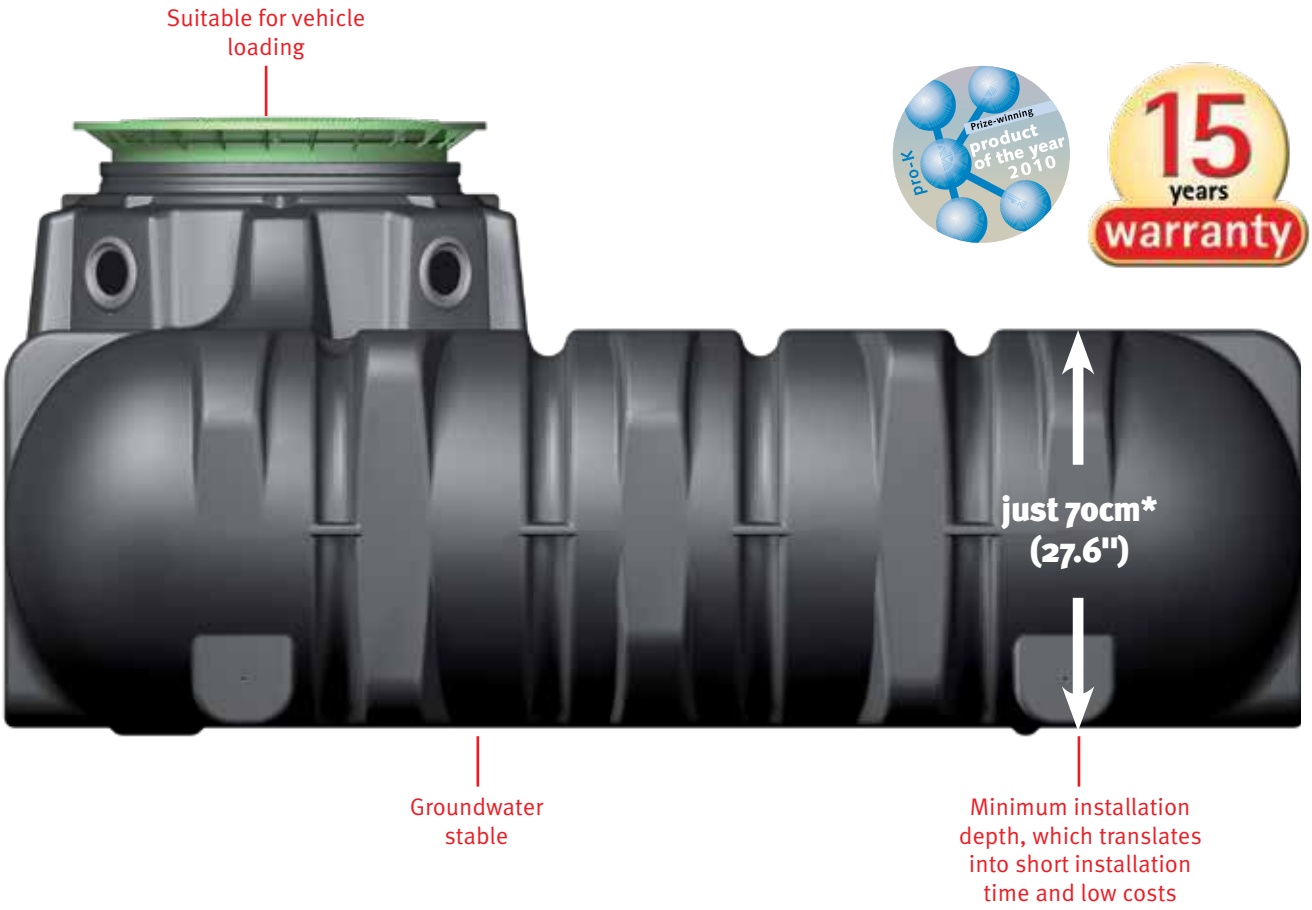
⑦ 100mm diameter drainage pipe connected from downpipes to the inlet at the top of the tank (all downpipes brought into one pipe for connection to the filter)

⑧ 100mm diameter pipe for overflow from the tank to mains drainage network or soakaway

⑨ Header tank package

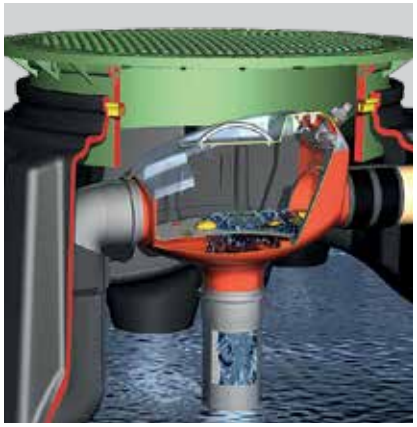
Benefits of the Platin® flat tank

GRAF brand quality - try it for yourself!



Integrated filter technology

Self-cleaning and low maintenance



Large tank dome

For optimum filter assembly and maintenance



Attractive tank cover

Continuously variable height and tilting, including child-proof locking



Choose your tank size

Flat tank Platin® - Suitable for vehicle loading in conjunction with the Telescopic dome shaft with cast iron lid (accessory)



1,500 litres
400 US-Gal
Order no. 390000

3,000 litres
800 US-Gal
Order no. 390001

5,000 litres
1,350 US-Gal
Order no. 390002

7,500 litres
1,980 US-Gal
Order no. 390005

Select your desired tank cover



Telescopic dome shaft Mini, suitable for pedestrian loading
Order no. 371010

Telescopic dome shaft Maxi, suitable for pedestrian loading
Order no. 371011



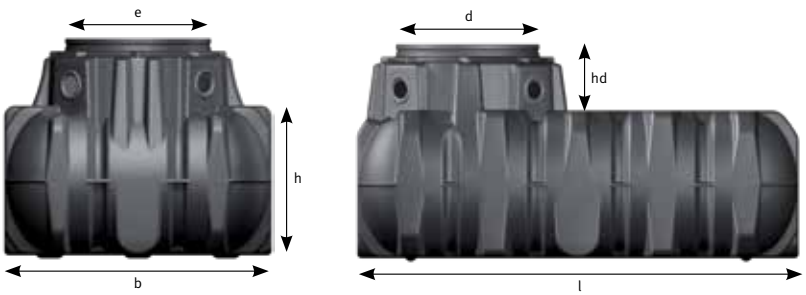
Telescopic dome shaft cast iron, suitable for vehicle loading
Order no. 371020



Water connection box internal
Draw water directly from the Platin flat tank. Can be easily upgraded with Mini telescopic dome shaft
Order no. 375119

Technical data

Dimensions/weight	1,500 litres	3,000 litres	5,000 litres	7,500 litres	10,000 litres	15,000 litres
Length (l)	2,100mm	2,450mm	2,280mm	3,600mm	4,900mm	7,500mm
Width (w)	1,250mm	2,100mm	2,300mm	2,250mm	2,250mm	2,250mm
Height of tank shoulder (h)	700mm	735mm	950mm	1,250mm	1,250mm	1,250mm
Height of dome collar (hd)	315mm	315mm	315mm	315mm	-	-
Ø inlet (e)	650mm	650mm	650mm	650mm	650mm	650mm
Ø tank dome (d)	800mm	800mm	800mm	800mm	870mm	870mm
Weight approx.	80kg	170kg	240kg	360kg	460kg	710kg



Installation of rainwater harvesting systems

GRAF Ireland Environmental provide a full installation service for anything from one-off single systems up to multiple systems for housing developments. We also provide a commissioning service and ongoing maintenance packages for individual clients or housing associations.

Complete installations include the following stages:





① Excavation of tank area & pipework trenches

② Tank assembly, installation & set up with tank dome & lid

③ Installation of filter unit within the top of the tank and connection to drainage pipes

④ Installation of the duct pipe from the tank to the property

⑤ Feed pipework through the duct, including pressure pipe, float sensor cable, power cable for the pump and pipes for mains water back to the tank

⑥ Install the submersible pump within the tank

⑦ Make mains water connection to the chosen pump package, except Garden Comfort package

⑧ Commission the whole system once the power and water supply have been connected and turned on

GRAF Ireland can provide a full installation package or any individual parts of the overall installation. For example, installation of the internal parts only followed by commissioning of the whole system.

All GRAF Ireland installations are provided with a minimum of 1 year contractor's warranty.

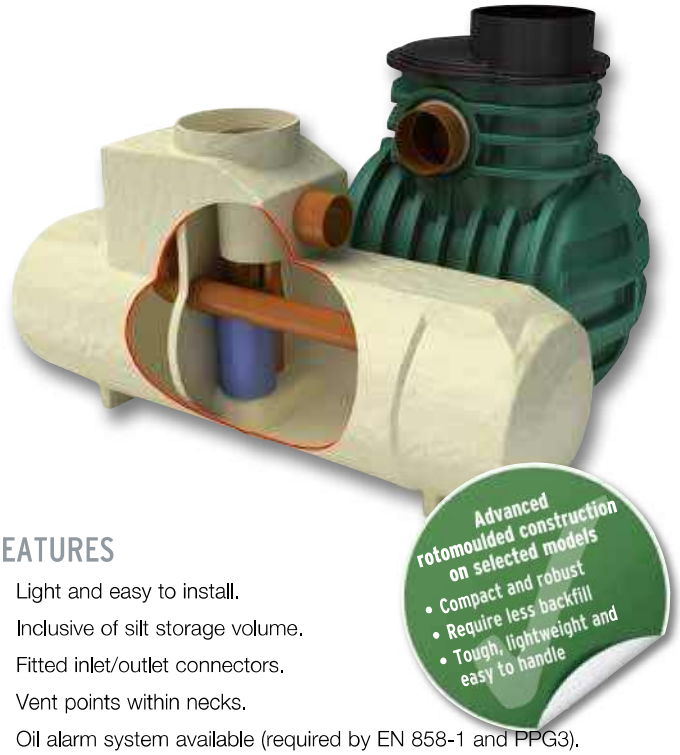
GRAF Ireland site staff are 100% safepass qualified.

Graf Ireland Environmental Ltd
Milltown Business Park
Milltown
Galway
H54 RD78
T: 093 51765
E: info@grafireland.ie
www.grafireland.ie

Your expert specialist dealer:

Appendix E – Bypass Separator Details

Bypass NSB RANGE



APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m²)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction GRP chamber construction * Some units have more than one access shaft – diameter of largest shown.

Appendix F – Stormtech Details

StormTech®

a product of ADS® Europe



Product Catalogue

Not intended for design layouts; refer to the appropriate "StormTech Design Manual" for specific chamber design information.

StormTech Subsurface Stomwater Management

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LEED® Credits.....5
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SC-740 Chamber Specifications.....8
DC-780 Chamber Specifications.....10
MC-3500 Chamber Specifications.....12
MC-4500 Chamber Specifications.....14
Isolator® Row.....16
A Family of Products and Services.....18
Customer Support.....19

StormTech has well over ten thousand chamber systems in service throughout the world. All StormTech chambers are designed to meet the most stringent industry performance standards for superior structural integrity. The StormTech system is designed primarily to be used under car parks, roadways and heavy earth loads saving valuable land and protecting water resources for commercial and municipal applications. In our continuing desire to answer designers' challenges, StormTech has expanded the family of products providing engineers, developers, regulators and contractors with additional site specific flexibility.

Advanced Structural Performance for Greater Long-Term Reliability

StormTech developed a state of the art chamber design through:

- Collaboration with world-renowned experts of buried drainage structures to develop and evaluate the structural testing program and product design
- Designing chambers to meet and exceed various European standards for both dynamic and long-term static loads.
- Subjecting the chambers to rigorous full-scale, third party testing, under severe loading conditions to verify their performance both under dynamic loads as well as long term static loads.

Our Chambers Provide...

- Extremely *efficient transportation.* Stacking of the chambers results in lower cost per m^3 installed volume while being more eco-friendly.
- A *remarkably quick installation.* For example: Ten of the MC-3500 chambers, providing a total installed storage of over 55 m^3, can be easily installed in 10 minutes. When installing the same 55 m^3 using box type systems you would need to install 125 to 250 boxes, taking significantly more time!
- The *strength* of concrete tanks, but at a very competitive price.
- A robust, *continuous, true elliptical arch design* which effectively transfers loads into the surrounding backfill providing the long-term safety factor required by various local standards. This offers developers a cost-effective underground system that will perform as designed for decades.
- A *design in accordance with various local European design specifications* providing engineers with a structural performance standard for live and long-term dead loads.
- Innovative *polypropylene and polyethylene* resins which have been tested using international standards to ensure long and short-term structural properties.
- Uniform wall thickness and repeatable quality due to *injection mold production.*
- Third party *tested and patented Isolator® Row* for less frequent maintenance, water quality, and long-term performance.
- *Traditional manifold/header designs* using conventional hydraulic equations that can easily verify flow equalization and scour velocity.
- *Open chamber design* requiring only one chamber model to construct each row assuring ease of construction and no repeating end walls to obstruct access or flow.

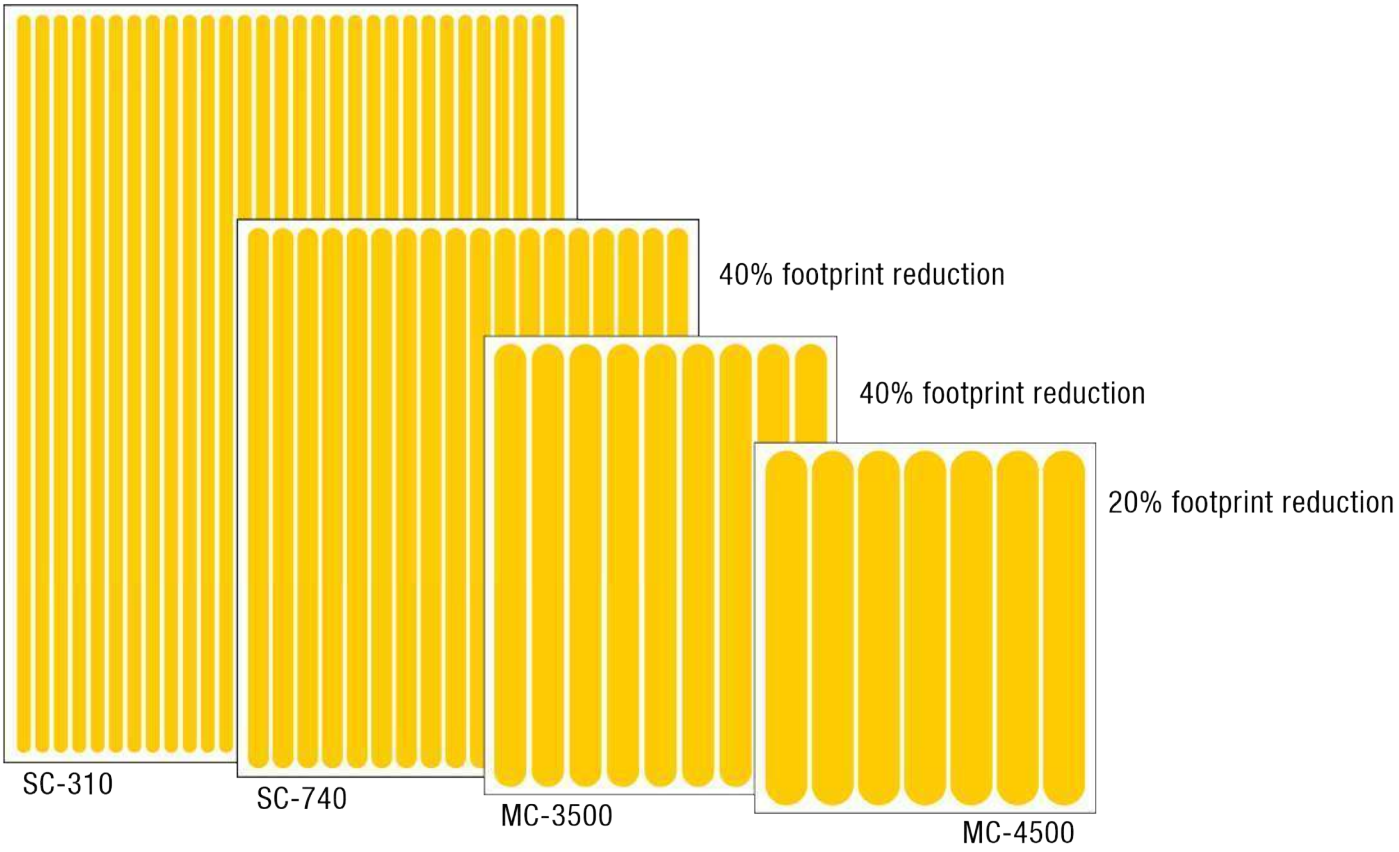
StormTech offers a variety of chamber sizes (SC-310, SC-740, DC-780, MC-3500 and MC-4500) so the consulting design engineer can choose the chamber that is best suited for the site conditions and regulatory requirements. StormTech has well over ten thousand chamber systems in service worldwide. We provide plan layout and cost estimate services at no charge for consulting engineers and developers.

StormTech Specifications and Product Comparison

PRODUCT SPECIFICATIONS	SC-310	SC-740	DC-780	MC-3500	MC-4500
Height, mm	405	760	760	1140	1525
Width, mm	865	1295	1295	1955	2540
Length, mm	2300	2300	2300	2285	1320
Installed Length, mm	2170	2170	2170	2185	1230
Bare Chamber Storage, m^3	0.42	1.30	1.30	3.11	3.01
Stone above, mm	150	150	150	300	300
Foundation Stone, mm*	150	150	230	230	230
Row Spacing, mm	150	150	150	150	230
Minimum Installed Storage, m^3	**0.88**	**2.12**	**2.22**	**5.06**	**4.60**
Storage Per Unit Area, m^3	0.39	0.67	0.70	1.06	1.35

**Please refer to the design manual.*

Example: Footprint Comparison - 1000m^3 Project



StormTech BREEAM® Credits

List of BREEAM Credits that StormTech may contribute toward:

LAND USE AND ECOLOGY

- **Credit LE3 Ecological Value of Site and Protection of Ecological Features**
  Utilizing StormTech System beneath roadways, surface parking, walkways, etc. may reduce overall site disturbance.
- **Credit LE4 Mitigating Ecological Impact**
  Utilizing StormTech System beneath roadways, surface parking, walkways, etc. may reduce overall site disturbance.

WATER

- **Credit Wat 5 Water Recycling**
  Utilize StormTech System to store captured rainwater to reduce potable water demand.
- **Credit Wat 6 Irrigation Systems**
  Utilize StormTech System to store captured rainwater for landscape irrigation.

MATERIALS

- **Credit Wst 2 Recycled Aggregates**
  Utilize recycled concrete as the backfill material for the StormTech System.

POLLUTION

- **Credit Pol 5 Flood Risk**
  Utilize StormTech System to reduce the impact of flooding on buildings with a medium-to-high risk of flooding.
- **Credit Pol 6 Minimizing Water Course Pollution**
  Utilize StormTech System to reduce potential for silt, heavy metals, chemicals or oil pollution to natural watercourses from surface water run-off from buildings and hard surfaces.

INNOVATION

- **Credit Inn 1 Innovation**
  Utilize StormTech System to substantially exceed a performance credit.

MANAGEMENT

- **Credit Man 11 Ease of Maintenance**
  Utilize StormTech System to meet this performance credit which is to recognize and encourage the specification of a building and building services that can be easily maintained during their lifecycle.

StormTech LEED® Credits

List of LEED Credits that StormTech may contribute toward:

SUSTAINABLE SITES

- **SS Credit 5.1 Site Development: Protect or Restore Habitat**
  Utilizing StormTech System beneath roadways, surface parking, walkways, etc. may reduce overall site disturbance.
- **SS Credit 5.2 Site Development: Maximize Open Space**
  Utilizing StormTech System can increase overall open space and may reduce overall site disturbance.
- **SS Credit 6.1 Stormwater Design: Quantity Control**
  Design StormTech System per local or LEED stormwater quantity requirements, whichever is more stringent.
- **SS Credit 6.2 Stormwater Design: Quality Control**
  Use of Isolator Row provides sediment removal, and can also promote infiltration and groundwater recharge.
- **SS Credit 7.1 Heat Island Effect: Non-Roof**
  Use of StormTech System may eliminate need for above ground detention ponds, thus reducing thermal impacts of stormwater runoff.

WATER EFFICIENCY

- **WE Credit 1 Water Efficient Landscaping**
  Utilize StormTech System to store captured rainwater for landscape irrigation.
- **WE Credit 2 Innovative Water Technologies**
  Utilize StormTech System to store captured rainwater to reduce potable water demand.
- **WE Credit 3 Water Use Reduction**
  Utilize StormTech System to store captured rainwater and allow reuse for non-potable applications.

MATERIALS

- **MR Credit 4 Recycled Content**
  Utilize recycled concrete as the backfill material for the StormTech System.
- **MR Credit 5 Regional Materials**
  Stone backfill material for the StormTech System will apply if extracted within 500 miles of project site.

INNOVATION & DESIGN

- **ID Credit 1 Innovation in Design**
  Utilize StormTech System to substantially exceed a performance credit.

StormTech SC-310 Chamber Specifications

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech SC-310 system is designed primarily to be used under car parks thus maximizing land usage for commercial and municipal applications.







StormTech SC-310 Chamber (not to scale)

Nominal Chamber Specifications

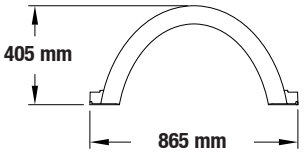
Size (L x W x H)	2170 x 865 x 405 mm
Chamber Storage	0.42 m^3
Min. Installed Storage*	0.88 m^3
Weight	17.5 kg

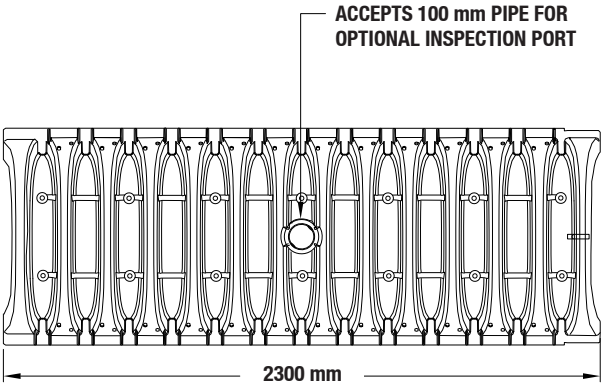
**Assumes 150 mm stone above, below and between chambers and 40% stone porosity.*

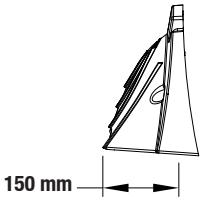
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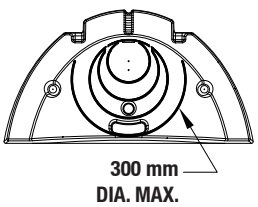
656 chambers per truck

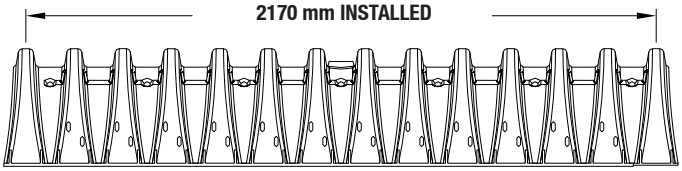
(over 580 m^3 storage per truck)







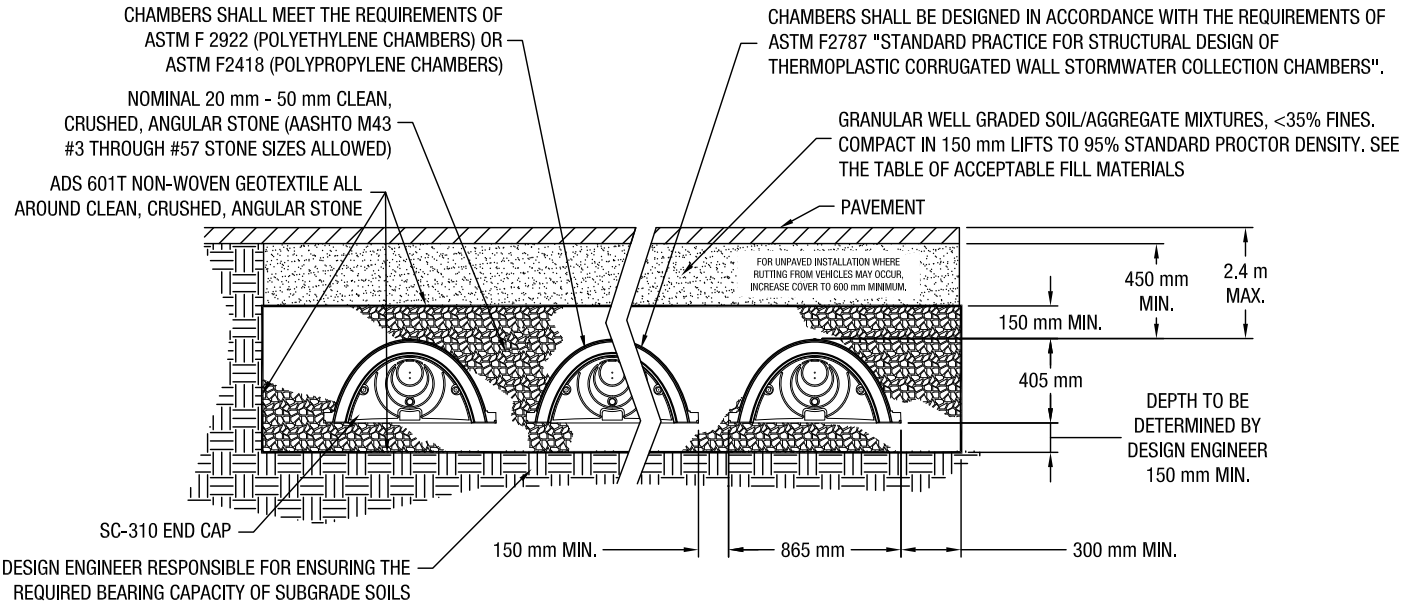




StormTech SC-310 Chamber Specifications







THIS CROSS SECTION DETAILS THE REQUIREMENTS NECESSARY TO SATISFY THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR EARTH AND LIVE LOADS USING STORMTECH CHAMBERS.





StormTech SC-740 Chamber Specifications

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech SC-740 system is designed primarily to be used under car parks thus maximizing land usage for commercial and municipal applications.







StormTech SC-740 Chamber (not to scale)

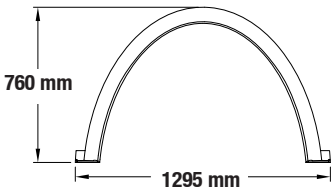
Nominal Chamber Specifications

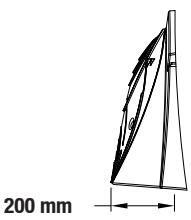
Size (L x W x H)	2170 x 1295 x 760 mm
Chamber Storage	1.30 m^3
Min. Installed Storage*	2.12 m^3
Weight	35.5 kg

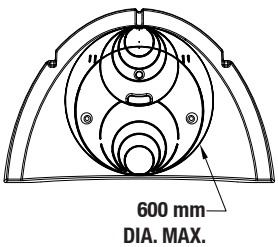
**Assumes 150 mm stone above, below and between chambers and 40% stone porosity.*

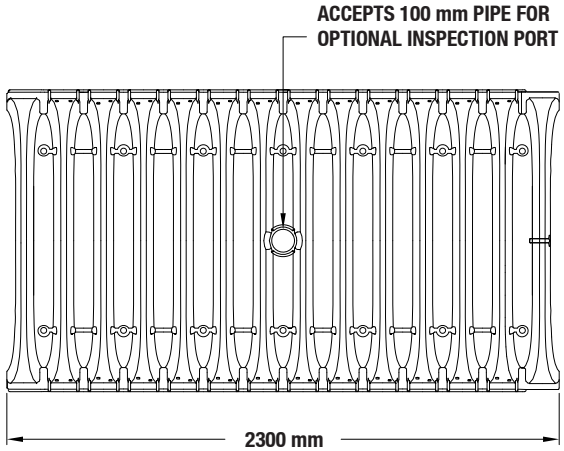
Transportation:

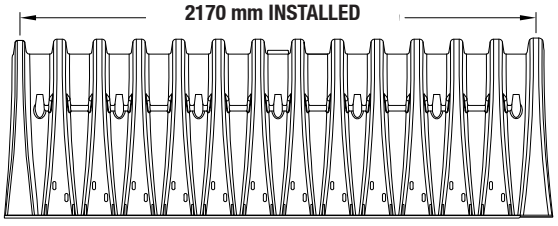
300 chambers per truck
(635 m^3 storage per truck)







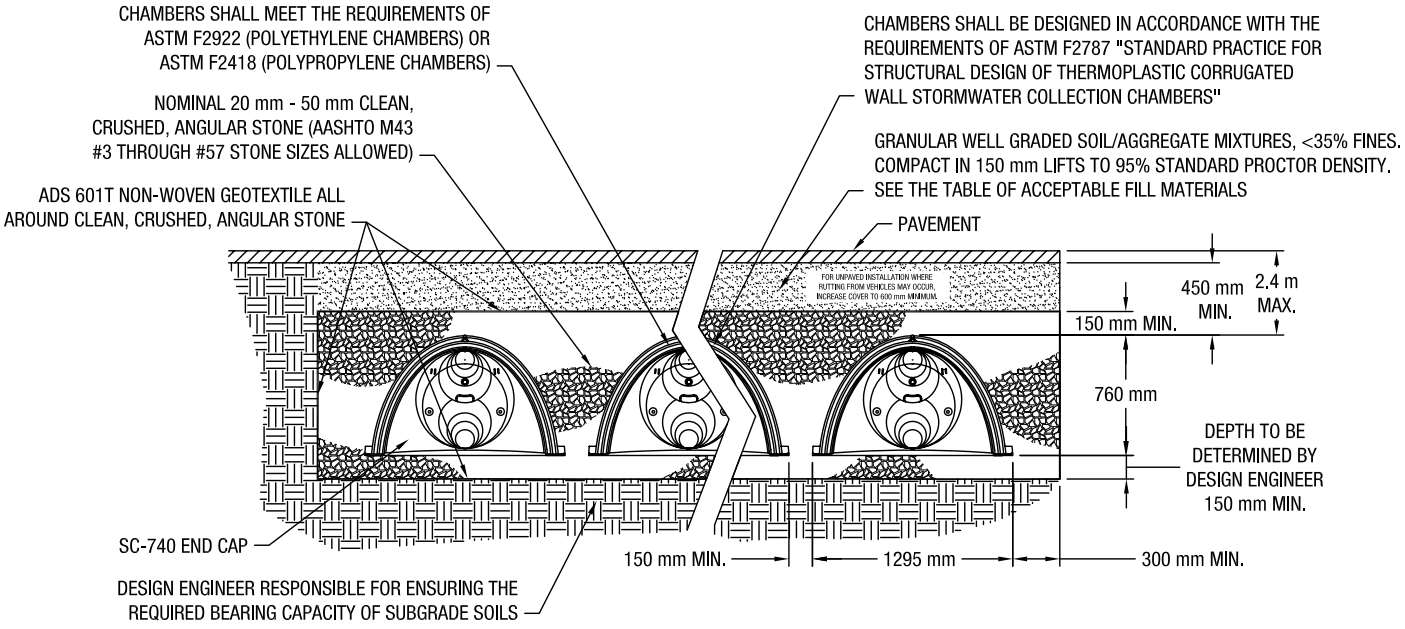




StormTech SC-740 Chamber Specifications







THIS CROSS SECTION DETAILS THE REQUIREMENTS NECESSARY TO SATISFY THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS USING STORMTECH CHAMBERS

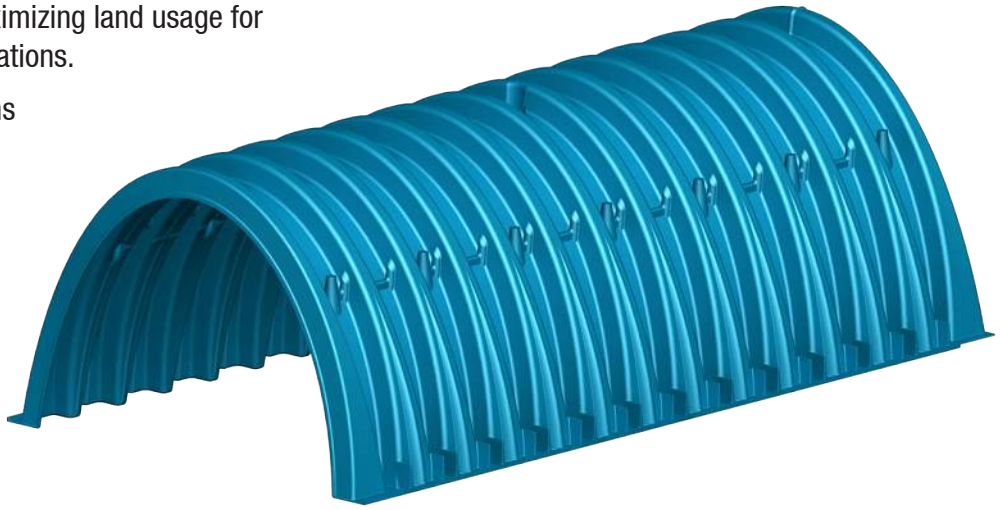




StormTech DC-780 Chamber Specifications

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech DC-780 system is designed specifically to be used for deep cover applications thus maximizing land usage for commercial and municipal applications.

- 3.7 m Deep Cover applications



StormTech DC-780 Chamber (not to scale)

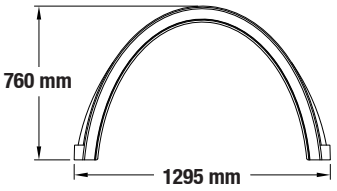
Nominal Chamber Specifications

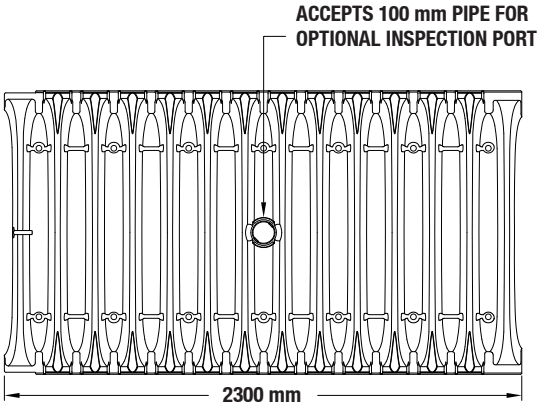
Size (L x W x H)	2170 x 1295 x 760 mm
Chamber Storage	1.30 m^3
Min. Installed Storage*	2.20 m^3

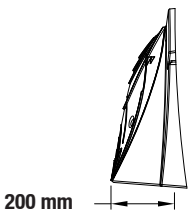
**Assumes 230 mm stone below, 150 mm stone above, and 150 mm row-spacing chambers and 40% stone porosity.*

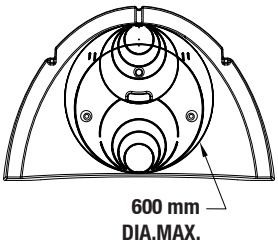
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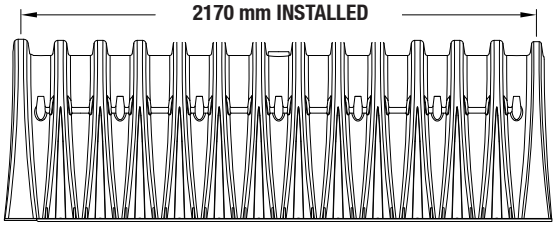
240 chambers per truck
(530 m^3 storage per truck)







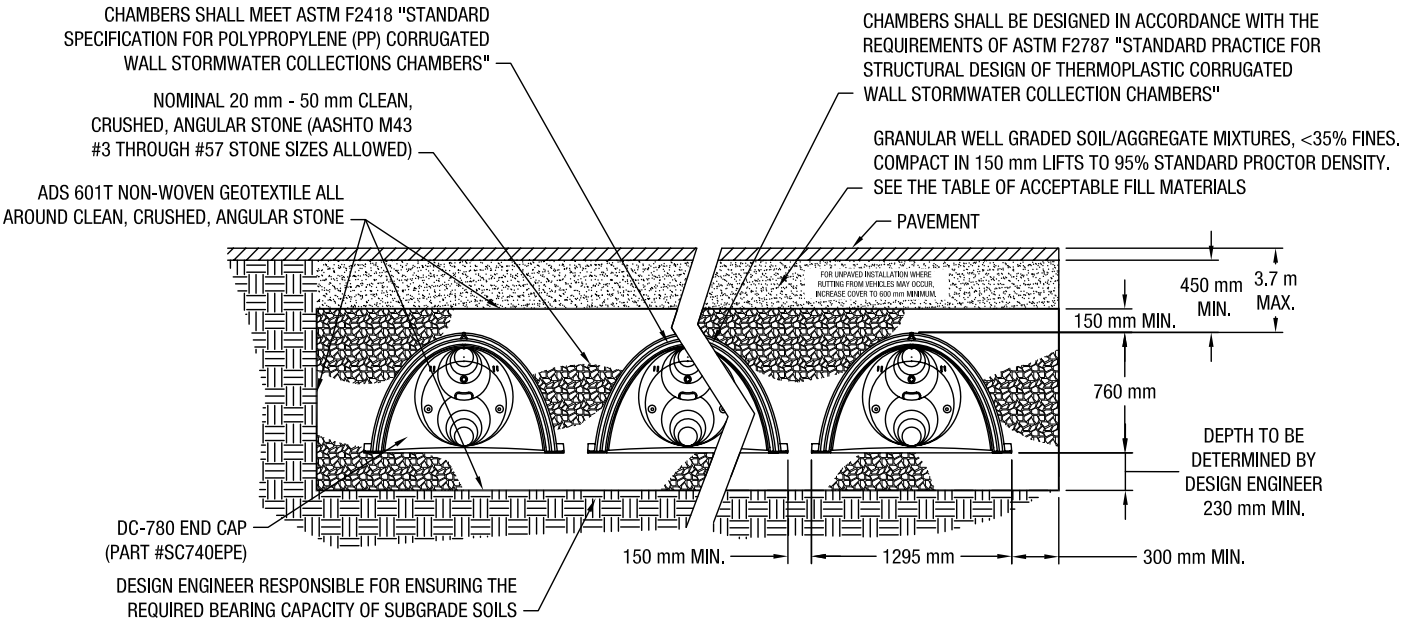




StormTech DC-780 Chamber Specifications







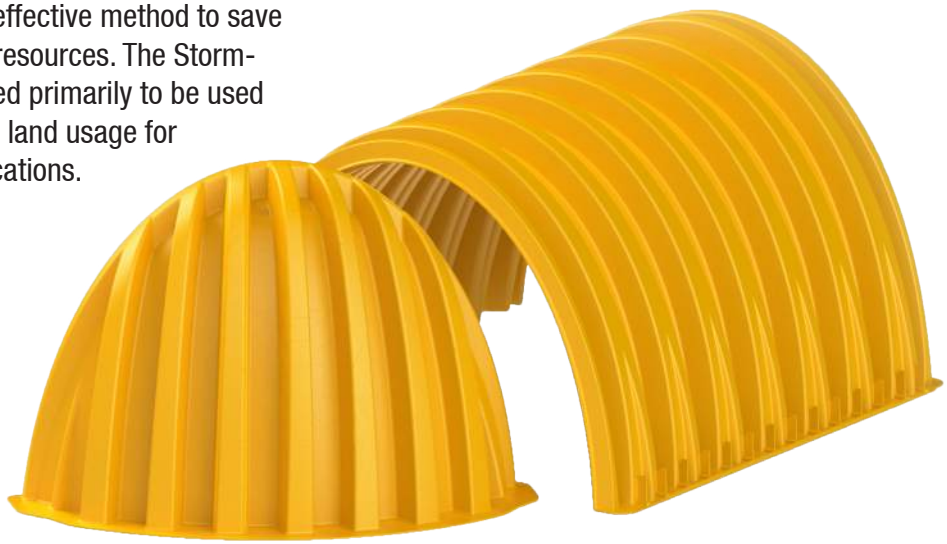
THIS CROSS SECTION DETAILS THE REQUIREMENTS NECESSARY TO SATISFY THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS USING STORMTECH CHAMBERS





StormTech MC-3500 Chamber Specifications

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech MC-3500 system is designed primarily to be used under car parks thus maximizing land usage for commercial and municipal applications.



StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	2285 x 1955 x 1145 mm
Chamber Storage	3.11 m^3
Min. Installed Storage*	5.06 m^3
Weight	56.5 kg

**Assumes a minimum of 305 mm of stone above, 230 mm of stone below, chambers, 230 mm of stone between chambers/end caps, and 40% stone porosity.*

StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

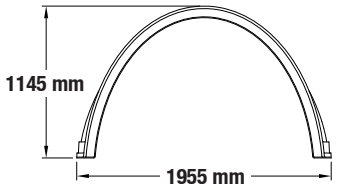
Size (L x W x H)	675 x 1805 x 1145 mm
End Cap Storage	0.44 m^3
Min. Installed Storage*	1.33 m^3
Weight	19.5 kg

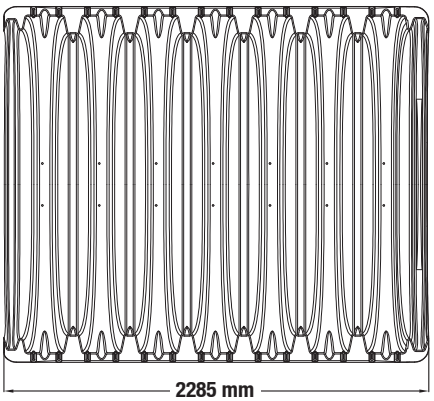
**Assumes a minimum of 305 mm stone above, 230 mm stone below, 150 mm stone perimeter, 230 mm of stone between chambers/end caps, and 40% stone porosity.*

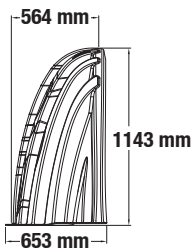
Transportation:

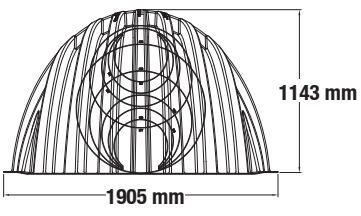
135 chambers per truck

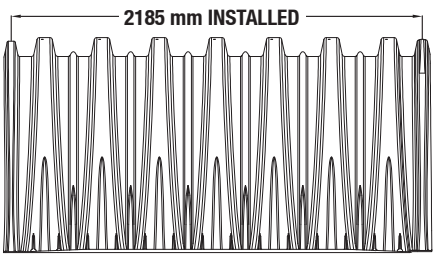
(over 685 m^3 storage per truck)







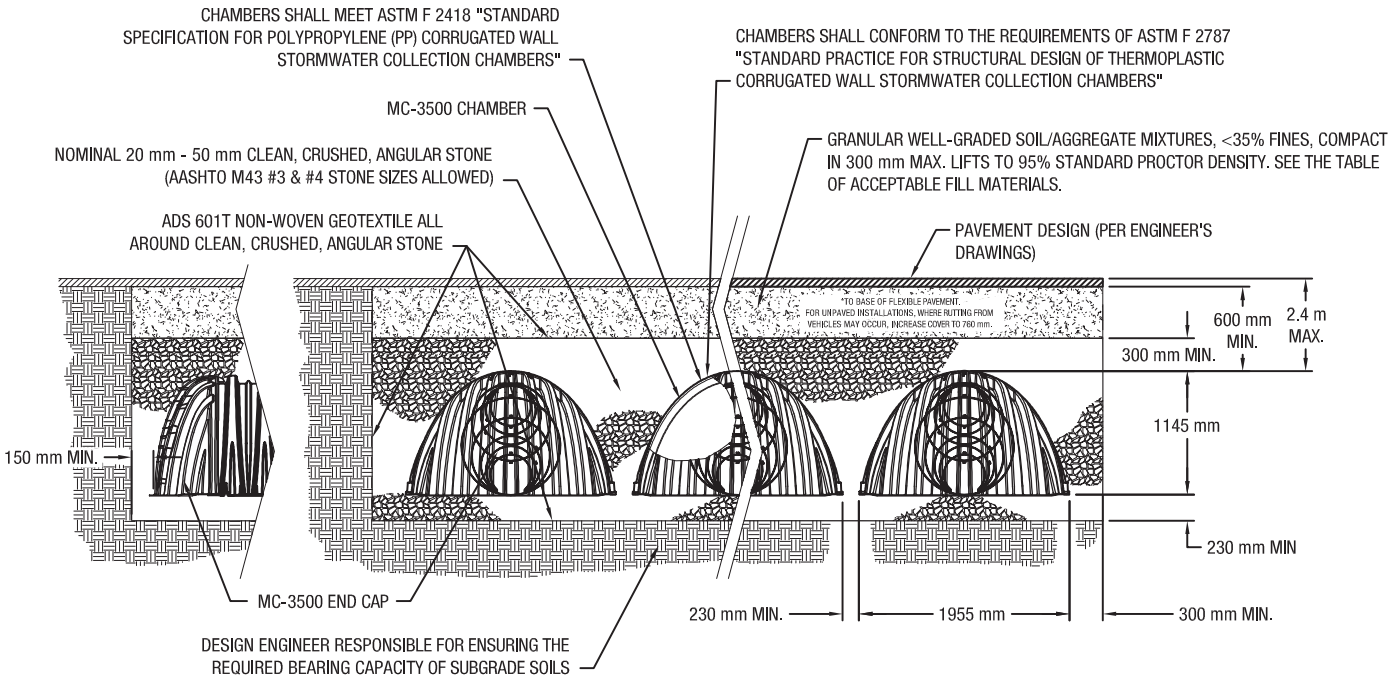




StormTech MC-3500 Chamber Specifications





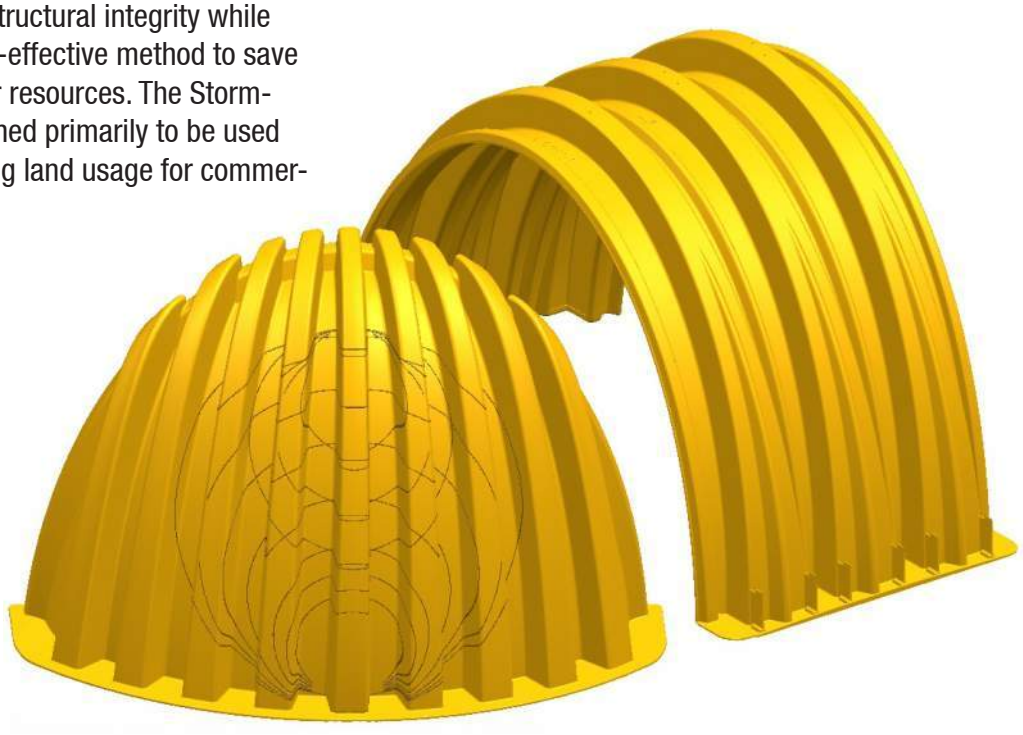






StormTech MC-4500 Chamber Specifications

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech MC-4500 system is designed primarily to be used under car parks thus maximizing land usage for commercial and municipal applications.



StormTech MC-4500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	1320 x 2540 x 1525 mm
Chamber Storage	3.01 m^3
Min. Installed Storage*	4.60 m^3
Nominal Weight	53.5 kg

**Assumes a minimum of 300 mm of stone above, 230 mm of stone below chambers, 230 mm of stone between chambers/end caps, and 40% stone porosity.*

StormTech MC-4500 End Cap (not to scale)

Nominal End Cap Specifications

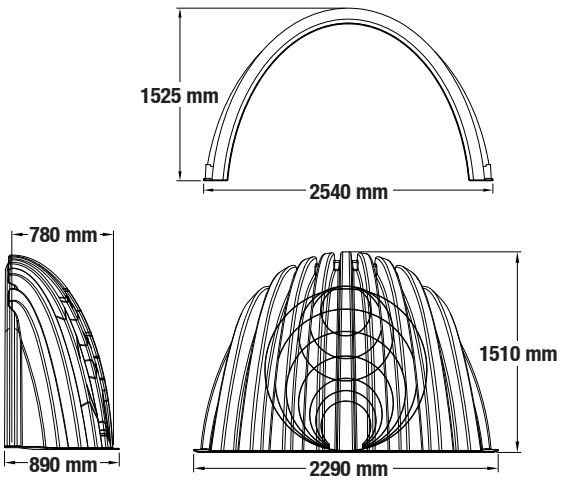
Size (L x W x H)	890 x 2290 x 1510 mm
End Cap Storage	1.01 m^3
Min. Installed Storage*	3.08 m^3
Nominal Weight	53.5 kg

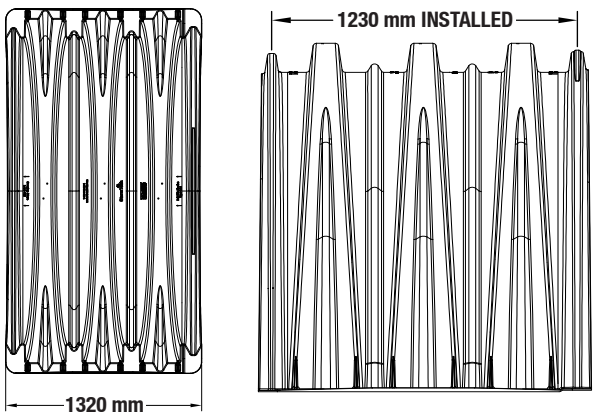
**Assumes a minimum of 300 mm of stone above, 230 mm of stone below, 305 mm of stone perimeter, 230 mm of stone between chambers/end caps, and 40% stone porosity.*

Transportation:

84 chambers per truck

(over 385 m^3 storage per truck)

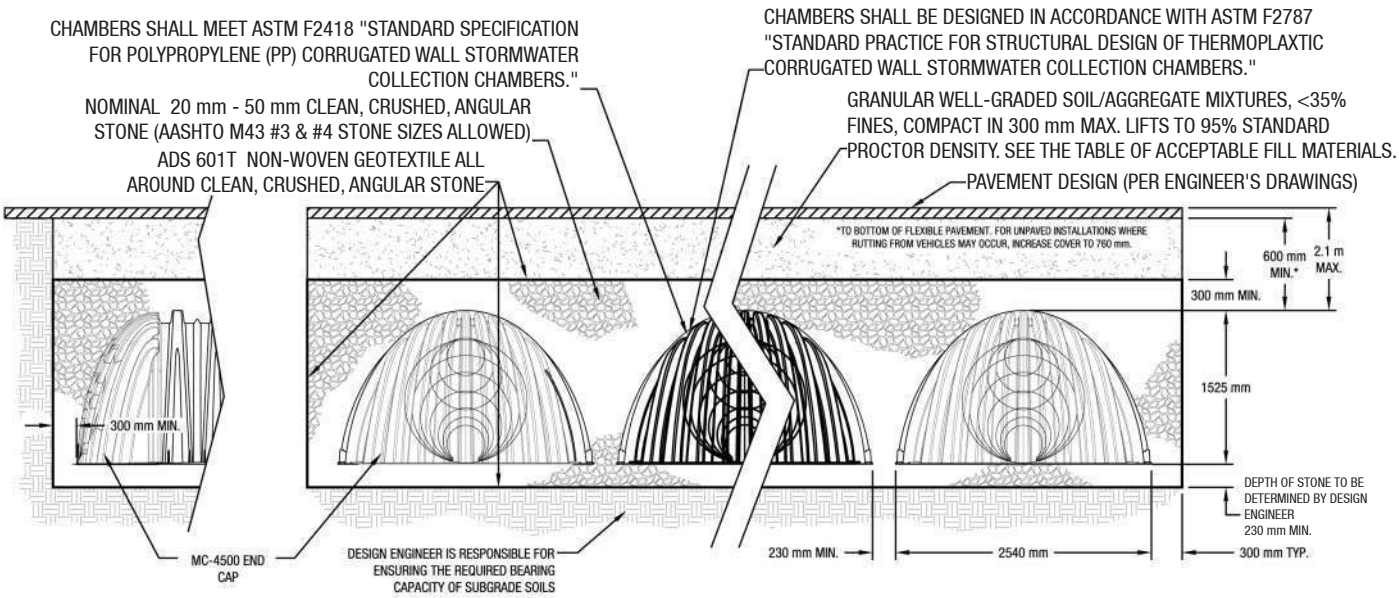




StormTech MC-4500 Chamber Specifications







THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.





StormTech Isolator® Row



An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively improve stormwater quality and provide easy access for inspection and maintenance. By using the StormTech Isolator Row a TSS removal of 80%, a hydrocarbon (diesel) removal of 90%, a total Zinc removal of 53% and a total Phosphorus removal of 49% can be achieved.*

The Isolator Row is a row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as stormwater rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row, protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for stormwater filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row, but typically includes a high flow weir such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row crest the weir and discharge through a manifold to the other chambers.

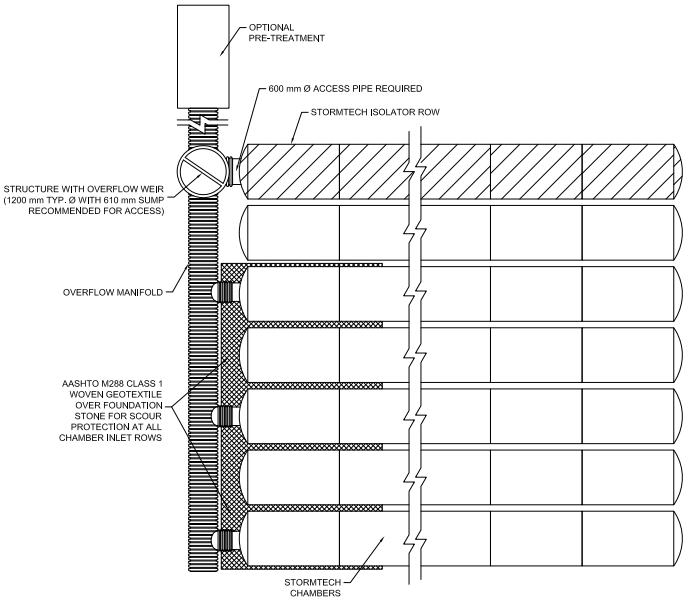
The Isolator Row may also be part of a treatment train. By treating stormwater prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins and oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

*Based on independent university testing.

StormTech Isolator Row with Overflow Spillway

(not to scale)



StormTech Isolator Row

Inspection

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If, upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 8 cm throughout the length of the Isolator Row, clean-out should be performed.

Maintenance

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s)



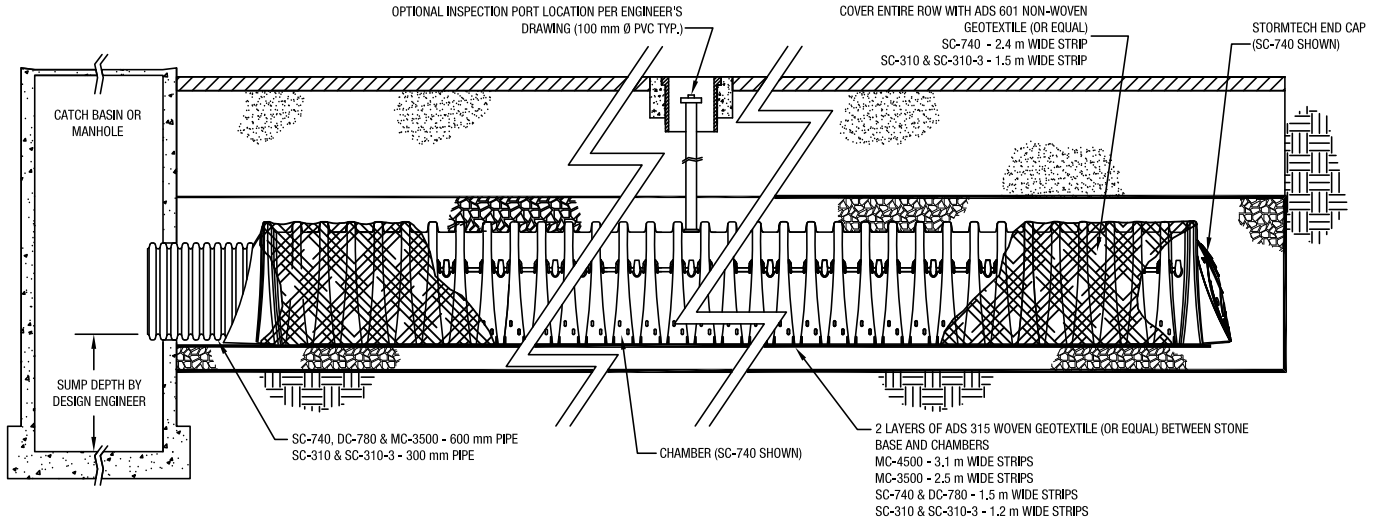




of the row for cleanout. If entry into the manhole is required, please follow the applicable rules and regulations for a confined space entries.

Maintenance is accomplished by jetting the Isolator Row. The jetting process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/jetting combination vehicles. Selection of an appropriate jetting nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45° are best. Most jetting reels have 120 meters of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The jetting process shall only be performed on StormTech Isolator Rows that have the correct woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

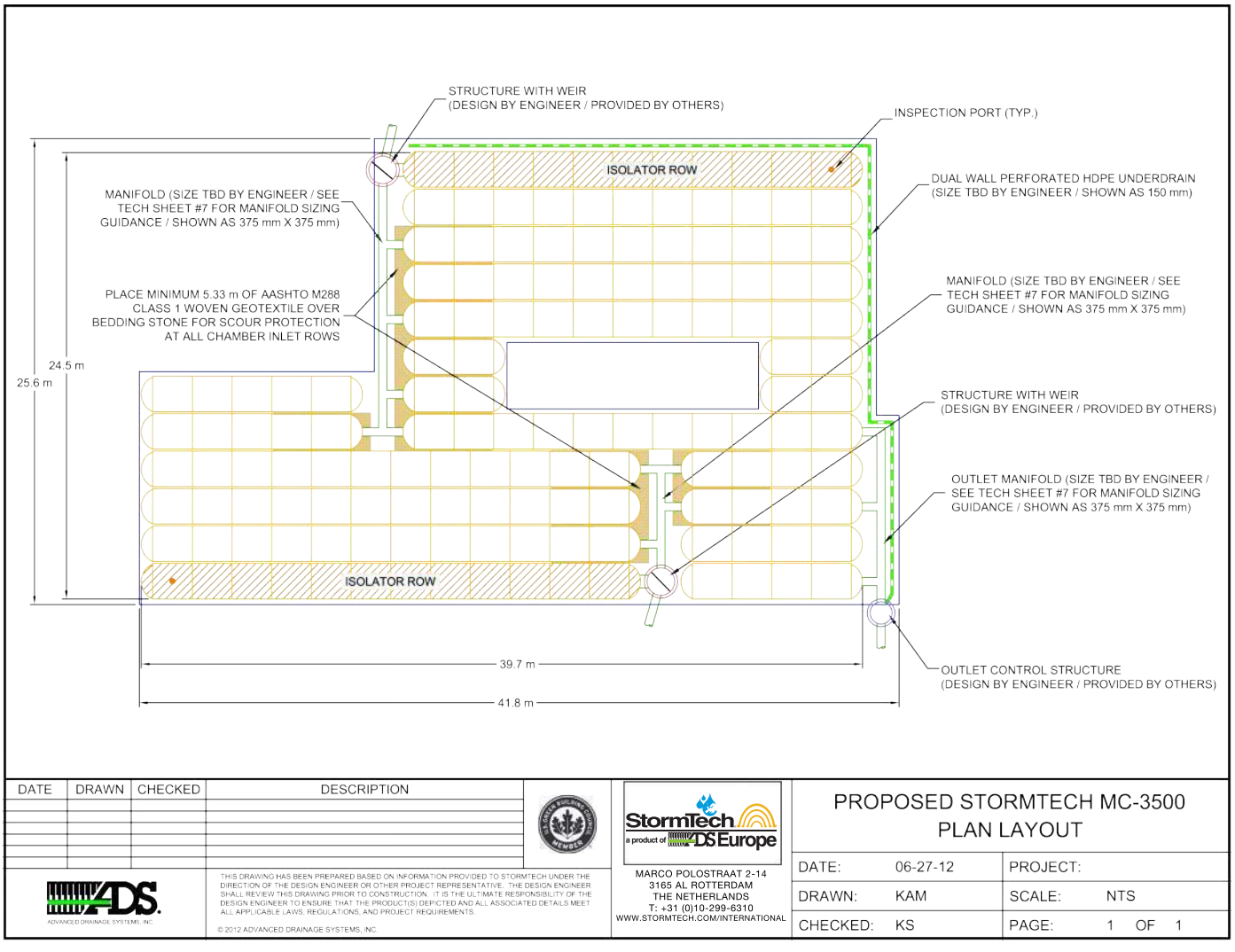


NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

A Family of Products and Services

- SC-310 Chambers and End Caps
- SC-740 Chambers and End Caps
- DC-780 Chambers and End Caps
- MC-3500 Chambers and End Caps
- MC-4500 Chambers and End Caps
- SC, DC and MC Fabricated End Caps
- Fabricated Manifold Fittings
- Patented Isolator Row for Maintenance and Water Quality
- In-House System Layout Assistance
- On-Site Educational Seminars
- Worldwide Technical Sales Group
- Centralized Product Applications Department
- Research and Development Team
- Technical Literature, O&M Manuals and Detailed CAD drawings all downloadable via our website at **www.stormtech.com/international**

"Interested in using StormTech products in your design? We would be glad to help you. StormTech provides plan layout and cost estimate services at no additional charge for consulting engineers and developers."



StormTech Customer Support



Please contact one of our inside Technical Service professionals or Engineered Product Managers (EPMs) to discuss your particular application. A wide variety of technical support material is available from our website at **www.stormtech.com/international.** For any questions, please call StormTech at **+31 (0)10 2996410.**

- SC-310, SC-740, and DC-780 Design Manual
- MC-3500 and MC-4500 Design Manual
- SC-310, SC740, and DC-780 Installation Instructions
- MC-3500 and MC-4500 Installation Videos
- Infiltrator Row Informational Video
- CAD Drawings
- Technical Sheets
- Site Calculator Spreadsheets
- Installation Guidelines and Industry Standards
- Industry Links
- Free Layout Assistance
- Pre-construction Meetings
- Case Studies

StormTech



StormTech
a product of ADS Europe

Marco Polostraat 2-14 | 3165 AL | Rotterdam | The Netherlands
+31 (0) 10-299-6410

www.stormtech.com/international

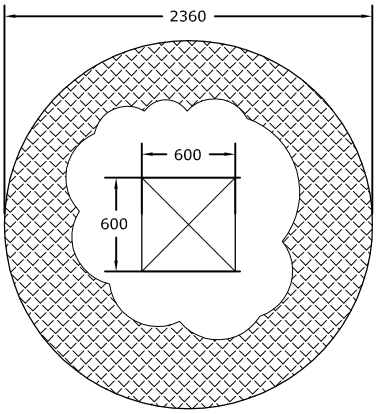
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Appendix G – Foul Sewer Holding Tank Details

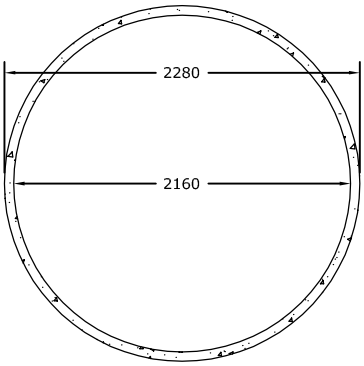
CARLOW CONCRETE TANKS	**DRAWING TITLE:** STANDARD 6.9m3 (1500 GALLON) Concrete Tank	**Drawn By:** T. Armstrong **Date:** 01/06/08 **Revision:** 0	

6.90 CUBIC METRE / 1500 GALLON TANK

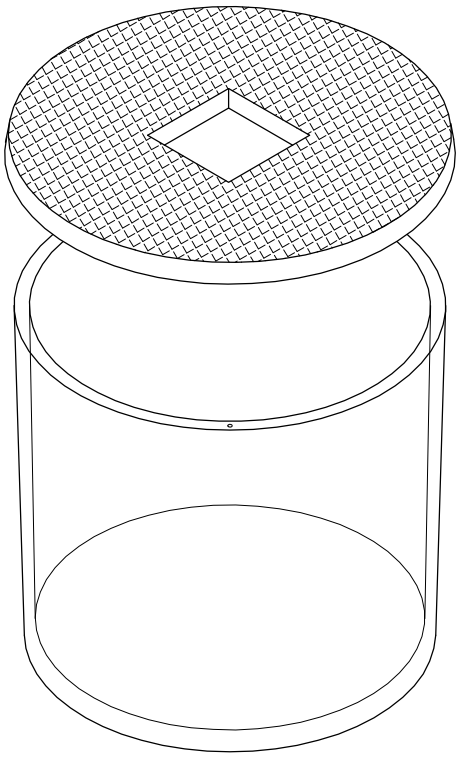


ROOF PLAN

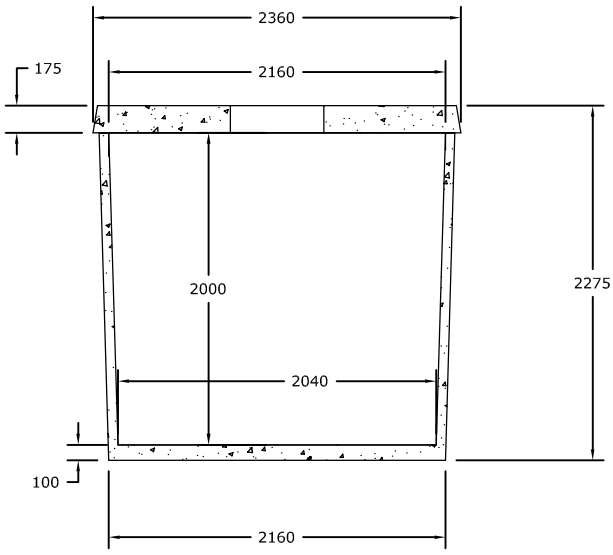
Standard tank weight 4.00 tonnes without lid, 5.40 tonnes including lid.



FLOOR PLAN



3D VIEW



SECTION

0m 1m 2m