

Clare County Council

Proposed Inis Cealtra Visitor Experience
Co. Clare

VOLUME III
APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT"



DECEMBER 2024

Document Control Sheet

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Prepared by	MKR	Checked by	PG	

Revision	Status	Issue Date
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Proposed Inis Cealtra Visitor Experience, Co. Clare.

APPENDIX 1.1

PROJECTS CONSIDERED IN CUMULATIVE ASSESSMENT



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

Inis Cealtra Visitor Experience

Projects Considered in Cumulative Assessment

Mountshannon Village

Table 1: List of proposed and permitted development in Mountshannon Village

Middleline South, Mountshannon, Co Clare	
For a Tertiary Treatment System and Infiltration/treatment area with polishing filter at the existing dwelling	CCC Reg. Ref. 2460553 Live Application Decision Due – 10 Jan. 2025
Mountshannon Community Hall, Mountshannon, Co. Clare, V94 F5A0	
Alterations and demolition works to the existing Community Hall, the construction of a sports hall and Arts centre and ancillary buildings along with all associated site works	CCC Reg. Ref. 2460460 Live Application RFI - 19 Nov. 2024
Cloonoolia South, Mountshannon, Co. Clare	
Erection of a dwelling house and garage, entrance and driveway and install an effluent treatment system and soil polishing filter and all associated site works	CCC Reg. Ref. 2460454 Decision to Grant - 14 Nov. 2024
4 An Garran, Mounshannon, Co Clare V94 X00N	
The development will consist of an extension to a bedroom on the first floor, to the rear of the property, above the existing utility room	CCC Reg. Ref. 24394 Live Application Decision Due – 25 Jan. 2025
Sellernaun West, Mountshannon, Co Clare	
Living accommodation in converted attic area and associated site works to dwelling.	CCC Reg. Ref. 24302 Decision to Grant - 12 Oct. 2024
Cloonamirran Tld, Mountshannon, Co. Clare, V94D2VF	
Construction of a stable building and associated site works	CCC Reg. Ref. 2360438 Granted 8 th Dec 2023
Aistear Park, Mountshannon, Co Clare	
Erect a Pavilion (a roofed open structure) for communal, cultural, education and events and gatherings and all associated site works.	CCC Reg. Ref. 22123 Granted 6 th April 2022

	Appeal ABP Ref. 313431 Granted 24 th July 2023
The Old Rectory Mountshannon, Co. Clare, V94 P66V	
Alterations, modifications and change of use of the existing Old Rectory, Mountshannon (a Protected Structure, RPS No. 464) from Residential to Tourism Interpretive Centre and Café uses, on a site measuring 1.35ha. Note: This development is at an advanced stage of construction, with anticipated completion in Q1 2025. Thus, no overlap in construction activity will occur.	CCC Reg. Ref. 238001 Granted 10 th July 2023
Mountshannon, Co Clare	
Permission was granted for the construction of 11 no. dwelling houses of varying size and design, 1 no. building containing 2 no. apartments, new site entrance, development access roads paths, landscaping, service connections and associated site works & services.	CCC Reg. Ref. 22269 Granted - 3 May 2023
Public Realm Works Mainstreet Mountshannon, Co Clare	
Traffic Calming Measures at Main Street Mountshannon Note: The construction works for this development are scheduled to commence in mid-January 2025. As such, no overlap in construction activity is foreseen.	Section 38 Development

Surrounds of Lough Derg

Table 2: List of proposed and permitted development in the surrounds of Lough Derg

Co. Clare	
Kilana Lodge, Rahena More Ogonnelloe, Killaloe Co Clare., V94 W83C	
Change of Use from residential to recreational camping site and the construction of six no. cabins for the purpose of short stay accommodation and associated works. A Natura Impact statement will be submitted to the planning authority with the application	CCC Reg. Ref. 2360286 Decision to Grant - 02 Feb 2024 Live Appeal ABP -319124
Williamstown, Whitegate, Co Clare	

Two no boats/houseboats for use as short term tourism rentals	CCC Reg. Ref. 2360128 Granted 14 th June 2023
Drumman East, Williamstown Harbour, Whitegate, Co. Clare, V94 PY57	
The regeneration and redevelopment of existing buildings and land, for tourism and recreational purposes, including development of 4 no. residential lodges, café and retail units, 2 no. apartments, decking area and outdoor seating, floating jetty and all associated site development works. The proposed development is located within the curtilage of Williamstown Harbour a protected structure RPS 350. A Natura Impact Statement has been prepared.	CCC Reg. Ref. 2460336 Live Application, 12/09/24 – RFI
CCC Development- AA Application Ballycuggaran, Killaloe, Co. Clare	
Proposed Fáilte Ireland Platforms for Growth - shared WC, Shower, and Changing Room facilities. A Natura Impact Statement has been prepared.	ABP Ref. 313140 Granted 3 rd July 2023
Co. Tipperary	
Dromineer Quay, Dromineer, Co Tipperary	
the seasonal installation of a timber canoe and SUP storage platform and jetty from 1st May to 14th September which will be installed in conjunction with the inflatable water park and mobile service unit granted permission under Planning Ref. No. 17600541, including all associated site works. A Natura Impact Statement (NIS) has been prepared.	TCC Reg. Ref. 2260155 Granted 25 th May 2022
Lough Derg Yacht Club, Dromineer, Nenagh, Co. Tipperary	
improvements to the boat mooring facilities, new c. 2 m wide walkway/pier, proprietary "Versa-Dock" part floating docking system for mooring an RNLI rescue rigid inflatable boat (RIB) and associated site works	TCC Reg. Ref. 20251 Granted 17 th June 2020
TCC Development- AA Application - Dromineer, Co. Tipperary	
Construction of a facility centre for water sports activities and all associated works. A Natura Impact Statement has been prepared.	ABP Reg. Ref. 313916 Granted 06 th Oct 2022
Co. Galway	
Portumna Demense, Portumna, Fairhill, Co. Galway	
Construction of a new multi-use shared leisure route between Portumna Bridge and Lough Derg Water Recreation Park and a new 8 berth marina,	GCC Reg. Ref. 191287

and associated works. The proposal will involve works to or within the curtilage of the following protected structures; Portumna Harbour, Fairyhill (RPS 477) and Portumna Castle, Portumna Demesne (PRS 3785). A Natura Impact Statement has been prepared.	Granted 15 th June 2020
Portumna Demense, Co. Galway	
Installation of an inflatable Aqua Park that will operation seasonally from May 1st to September 30th inclusive and associated site works. A Natura Impact Statement (NIS) has been prepared.	GCC Reg. Ref. 2260326 Granted 16 th Nov 2022

Proposed Inis Cealtra Visitor Experience, Co. Clare.

APPENDIX 6.1

PICADY JUNCTION CAPACITY ANALYSIS



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2032 Weekday AM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

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                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
11.00 - 11.15		ARM A	0.000	0.059	0.772	0.168						
			0.0	6.0	78.0	17.0						
			(0.0)	(0.0)	(3.9)	(5.9)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.878	0.043	0.000	0.078						
			101.0	5.0	0.0	9.0						
			(11.9)	(0.0)	(0.0)	(0.0)						
		ARM D	0.417	0.000	0.583	0.000						
			5.0	0.0	7.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

11.15 - 11.30	ARM A	0.000	0.059	0.772	0.168
		0.0	6.0	78.0	17.0
		(0.0)	(0.0)	(3.9)	(5.9)
	ARM B	0.000	0.000	0.000	0.000
		I???????	I???????	I???????	I???????
		(0.0)	(0.0)	(0.0)	(0.0)
	ARM C	0.878	0.043	0.000	0.078
		101.0	5.0	0.0	9.0
		(11.9)	(0.0)	(0.0)	(0.0)
	ARM D	0.417	0.000	0.583	0.000
		5.0	0.0	7.0	0.0
		(0.0)	(0.0)	(0.0)	(0.0)

		TURNING PROPORTIONS			
		TURNING COUNTS			
		(PERCENTAGE OF H.V.S)			
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D
11.30 - 11.45	ARM A	0.000	0.059	0.772	0.168
		0.0	6.0	78.0	17.0
		(0.0)	(0.0)	(3.9)	(5.9)
	ARM B	0.000	0.000	0.000	0.000
		I???????	I???????	I???????	I???????
		(0.0)	(0.0)	(0.0)	(0.0)
	ARM C	0.878	0.043	0.000	0.078
		101.0	5.0	0.0	9.0
		(11.9)	(0.0)	(0.0)	(0.0)
	ARM D	0.417	0.000	0.583	0.000
		5.0	0.0	7.0	0.0
		(0.0)	(0.0)	(0.0)	(0.0)
11.45 - 12.00	ARM A	0.000	0.059	0.772	0.168
		0.0	6.0	78.0	17.0
		(0.0)	(0.0)	(3.9)	(5.9)
	ARM B	0.000	0.000	0.000	0.000
		I???????	I???????	I???????	I???????
		(0.0)	(0.0)	(0.0)	(0.0)
	ARM C	0.878	0.043	0.000	0.078
		101.0	5.0	0.0	9.0
		(11.9)	(0.0)	(0.0)	(0.0)
	ARM D	0.417	0.000	0.583	0.000
		5.0	0.0	7.0	0.0
		(0.0)	(0.0)	(0.0)	(0.0)

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.00	7.71	0.000		0.0	0.0	0.0	
A-BCD	0.29	10.84	0.027		0.0	0.0	0.5	
A-B	0.09							
A-C	1.14							
D-ABC	0.18	8.71	0.021		0.0	0.0	0.3	
C-ABD	0.09	11.67	0.007		0.0	0.0	0.1	
C-D	0.13							
C-A	1.51							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.00	7.68	0.000		0.0	0.0	0.0	
A-BCD	0.31	10.86	0.028		0.0	0.0	0.5	
A-B	0.09							
A-C	1.20							
D-ABC	0.19	8.67	0.022		0.0	0.0	0.3	
C-ABD	0.09	11.70	0.008		0.0	0.0	0.1	
C-D	0.14							
C-A	1.59							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I									
SEGMENT) I									
I	11.30-11.45								
I									
I	B-ACD	0.00	7.63	0.000		0.0	0.0	0.0	
I									
I	A-BCD	0.35	10.91	0.032		0.0	0.0	0.6	
I									
I	A-B	0.10							
I									
I	A-C	1.33							
I									
I	D-ABC	0.21	8.60	0.024		0.0	0.0	0.4	
I									
I	C-ABD	0.10	11.76	0.009		0.0	0.0	0.1	
I									
I	C-D	0.16							
I									
I	C-A	1.75							
I									
I									
I									

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I									
SEGMENT) I									
I	11.45-12.00								
I									
I	B-ACD	0.00	7.61	0.000		0.0	0.0	0.0	
I									
I	A-BCD	0.36	10.92	0.033		0.0	0.0	0.7	
I									
I	A-B	0.11							
I									
I	A-C	1.38							
I									
I	D-ABC	0.22	8.57	0.026		0.0	0.0	0.4	
I									
I	C-ABD	0.11	11.80	0.009		0.0	0.0	0.2	
I									
I	C-D	0.16							
I									
I	C-A	1.84							
I									
I									
I									

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	19.5	I	19.5	I	2.3	I	2.3	I	0.12	I
I	A-B	I	5.8	I	5.8	I		I		I		I
I	A-C	I	75.9	I	75.9	I		I		I		I
I	D-ABC	I	12.0	I	12.0	I	1.4	I	1.4	I	0.12	I
I	C-ABD	I	5.9	I	5.9	I	0.5	I	0.5	I	0.09	I
I	C-D	I	8.9	I	8.9	I		I		I		I
I	C-A	I	100.2	I	100.2	I		I		I		I
I	ALL	I	228.3	I	228.3	I	4.3	I	4.3	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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***** PICADY 4 run completed.  
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2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2032 Weekday PM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 17.00 AND ENDS 18.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
17.00 - 17.15		ARM A	0.000	0.041	0.761	0.198						
			0.0	8.0	150.0	39.0						
			(0.0)	(0.0)	(5.3)	(0.0)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.898	0.020	0.000	0.082						
			132.0	3.0	0.0	12.0						
			(2.3)	(0.0)	(0.0)	(0.0)						
		ARM D	0.333	0.000	0.667	0.000						
			3.0	0.0	6.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	17.15 - 17.30	I	I	I	I	I	I					
I		I	ARM A	I	0.000	I	0.041	I	0.761	I	0.198	I
I		I		I	0.0	I	8.0	I	150.0	I	39.0	I
I		I		I	(0.0)	I	(0.0)	I	(5.3)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.898	I	0.020	I	0.000	I	0.082	I
I		I		I	132.0	I	3.0	I	0.0	I	12.0	I
I		I		I	(2.3)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.333	I	0.000	I	0.667	I	0.000	I
I		I		I	3.0	I	0.0	I	6.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	
I	17.30 - 17.45	I		I	I	I	I	I	I	I	I	I	
I		I	ARM A	I	0.000	I	0.041	I	0.761	I	0.198	I	
I		I		I	0.0	I	8.0	I	150.0	I	39.0	I	
I		I		I	(0.0)	I	(0.0)	I	(5.3)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I	
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM C	I	0.898	I	0.020	I	0.000	I	0.082	I	
I		I		I	132.0	I	3.0	I	0.0	I	12.0	I	
I		I		I	(2.3)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM D	I	0.333	I	0.000	I	0.667	I	0.000	I	
I		I		I	3.0	I	0.0	I	6.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I	17.45 - 18.00	I		I	I	I	I	I	I	I	I	I	
I		I	ARM A	I	0.000	I	0.041	I	0.761	I	0.198	I	
I		I		I	0.0	I	8.0	I	150.0	I	39.0	I	
I		I		I	(0.0)	I	(0.0)	I	(5.3)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I	
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM C	I	0.898	I	0.020	I	0.000	I	0.082	I	
I		I		I	132.0	I	3.0	I	0.0	I	12.0	I	
I		I		I	(2.3)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM D	I	0.333	I	0.000	I	0.667	I	0.000	I	
I		I		I	3.0	I	0.0	I	6.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.00-17.15								
B-ACD	0.00	7.27	0.000		0.0	0.0	0.0	
A-BCD	0.87	12.17	0.072		0.0	0.1	1.6	
A-B	0.13							
A-C	2.45							
D-ABC	0.16	8.07	0.020		0.0	0.0	0.3	
C-ABD	0.07	11.75	0.006		0.0	0.0	0.1	
C-D	0.21							
C-A	2.30							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.15-17.30								
B-ACD	0.00	7.23	0.000		0.0	0.0	0.0	
A-BCD	0.93	12.22	0.076		0.1	0.1	1.7	
A-B	0.14							
A-C	2.55							
D-ABC	0.17	8.02	0.021		0.0	0.0	0.3	
C-ABD	0.07	11.79	0.006		0.0	0.0	0.1	
C-D	0.22							
C-A	2.41							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	17.30-17.45								
I	B-ACD	0.00	7.36	0.000		0.0	0.0	0.0	
I	A-BCD	0.77	12.07	0.064		0.1	0.1	1.4	
I	A-B	0.12							
I	A-C	2.23							
I	D-ABC	0.14	8.18	0.017		0.0	0.0	0.3	
I	C-ABD	0.06	11.68	0.005		0.0	0.0	0.1	
I	C-D	0.19							
I	C-A	2.08							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	17.45-18.00								
I	B-ACD	0.00	7.40	0.000		0.0	0.0	0.0	
I	A-BCD	0.72	12.01	0.060		0.1	0.1	1.3	
I	A-B	0.11							
I	A-C	2.11							
I	D-ABC	0.14	8.23	0.017		0.0	0.0	0.3	
I	C-ABD	0.06	11.65	0.005		0.0	0.0	0.1	
I	C-D	0.18							
I	C-A	1.98							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.1
17.30	0.1
17.45	0.1
18.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	49.5	I	49.5	I	6.0	I	6.0	I	0.12	I
I	A-B	I	7.5	I	7.5	I		I		I		I
I	A-C	I	140.0	I	140.0	I		I		I		I
I	D-ABC	I	9.1	I	9.1	I	1.1	I	1.1	I	0.12	I
I	C-ABD	I	3.8	I	3.8	I	0.3	I	0.3	I	0.09	I
I	C-D	I	11.9	I	11.9	I		I		I		I
I	C-A	I	131.4	I	131.4	I		I		I		I
I	ALL	I	353.2	I	353.2	I	7.5	I	7.5	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY03.vpi" (drive-on-the-left) at 09:45:49 on Friday, 6 September
2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2032 Weekend AM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
11.00 - 11.15												
		ARM A	0.000	0.020	0.721	0.259						
			0.0	3.0	106.0	38.0						
			(0.0)	(0.0)	(0.1)	(0.0)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.928	0.013	0.000	0.059						
			142.0	2.0	0.0	9.0						
			(0.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.200	0.600	0.200	0.000						
			1.0	3.0	1.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

TIME	ARM	FROM/TO	ARM A	ARM B	ARM C	ARM D
11.15 - 11.30	ARM A	0.000	0.020	0.721	0.259	
		0.0	3.0	106.0	38.0	
		(0.0)	(0.0)	(0.1)	(0.0)	
	ARM B	0.000	0.000	0.000	0.000	
		I???????	I???????	I???????	I???????	
		(0.0)	(0.0)	(0.0)	(0.0)	
	ARM C	0.928	0.013	0.000	0.059	
		142.0	2.0	0.0	9.0	
		(0.1)	(0.0)	(0.0)	(0.0)	
	ARM D	0.200	0.600	0.200	0.000	
		1.0	3.0	1.0	0.0	
		(0.0)	(0.0)	(0.0)	(0.0)	

TURNING PROPORTIONS						
TURNING COUNTS						
(PERCENTAGE OF H.V.S)						
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D	
11.30 - 11.45	ARM A	0.000	0.020	0.721	0.259	
		0.0	3.0	106.0	38.0	
		(0.0)	(0.0)	(0.1)	(0.0)	
	ARM B	0.000	0.000	0.000	0.000	
		I???????	I???????	I???????	I???????	
		(0.0)	(0.0)	(0.0)	(0.0)	
	ARM C	0.928	0.013	0.000	0.059	
		142.0	2.0	0.0	9.0	
		(0.1)	(0.0)	(0.0)	(0.0)	
	ARM D	0.200	0.600	0.200	0.000	
		1.0	3.0	1.0	0.0	
		(0.0)	(0.0)	(0.0)	(0.0)	
11.45 - 12.00	ARM A	0.000	0.020	0.721	0.259	
		0.0	3.0	106.0	38.0	
		(0.0)	(0.0)	(0.1)	(0.0)	
	ARM B	0.000	0.000	0.000	0.000	
		I???????	I???????	I???????	I???????	
		(0.0)	(0.0)	(0.0)	(0.0)	
	ARM C	0.928	0.013	0.000	0.059	
		142.0	2.0	0.0	9.0	
		(0.1)	(0.0)	(0.0)	(0.0)	
	ARM D	0.200	0.600	0.200	0.000	
		1.0	3.0	1.0	0.0	
		(0.0)	(0.0)	(0.0)	(0.0)	

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.00	7.57	0.000		0.0	0.0	0.0	
A-BCD	0.66	11.57	0.057		0.0	0.1	1.1	
A-B	0.04							
A-C	1.50							
D-ABC	0.08	8.03	0.010		0.0	0.0	0.1	
C-ABD	0.04	11.94	0.003		0.0	0.0	0.0	
C-D	0.13							
C-A	2.13							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.00	7.54	0.000		0.0	0.0	0.0	
A-BCD	0.71	11.60	0.061		0.1	0.1	1.2	
A-B	0.04							
A-C	1.58							
D-ABC	0.08	7.97	0.010		0.0	0.0	0.2	
C-ABD	0.04	11.99	0.003		0.0	0.0	0.1	
C-D	0.14							
C-A	2.24							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	11.30-11.45								
I	B-ACD	0.00	7.47	0.000		0.0	0.0	0.0	
I	A-BCD	0.79	11.65	0.068		0.1	0.1	1.4	
I	A-B	0.05							
I	A-C	1.73							
I	D-ABC	0.09	7.87	0.011		0.0	0.0	0.2	
I	C-ABD	0.04	12.09	0.004		0.0	0.0	0.1	
I	C-D	0.16							
I	C-A	2.48							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	11.45-12.00								
I	B-ACD	0.00	7.44	0.000		0.0	0.0	0.0	
I	A-BCD	0.84	11.68	0.072		0.1	0.1	1.5	
I	A-B	0.05							
I	A-C	1.81							
I	D-ABC	0.10	7.82	0.013		0.0	0.0	0.2	
I	C-ABD	0.05	12.14	0.004		0.0	0.0	0.1	
I	C-D	0.16							
I	C-A	2.60							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	45.0	I	45.0	I	5.2	I	5.2	I	0.11	I
I	A-B	I	2.8	I	2.8	I		I		I		I
I	A-C	I	99.3	I	99.3	I		I		I		I
I	D-ABC	I	5.3	I	5.3	I	0.7	I	0.7	I	0.12	I
I	C-ABD	I	2.5	I	2.5	I	0.2	I	0.2	I	0.09	I
I	C-D	I	9.0	I	9.0	I		I		I		I
I	C-A	I	141.7	I	141.7	I		I		I		I
I	ALL	I	305.6	I	305.6	I	6.0	I	6.0	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
=====
```

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY04.vpi" (drive-on-the-left) at 09:50:38 on Friday, 6 September
2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2032 Weekend PM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.00 AND ENDS 17.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
16.00 - 16.15		ARM A	0.000	0.016	0.724	0.259						
			0.0	3.0	134.0	48.0						
			(0.0)	(0.0)	(0.1)	(0.0)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.854	0.038	0.000	0.108						
			158.0	7.0	0.0	20.0						
			(0.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.375	0.250	0.375	0.000						
			3.0	2.0	3.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	16.15 - 16.30	I	I	I	I	I	I					
I		I	ARM A	I	0.000	I	0.016	I	0.724	I	0.259	I
I		I		I	0.0	I	3.0	I	134.0	I	48.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.854	I	0.038	I	0.000	I	0.108	I
I		I		I	158.0	I	7.0	I	0.0	I	20.0	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.375	I	0.250	I	0.375	I	0.000	I
I		I		I	3.0	I	2.0	I	3.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	
I	16.30 - 16.45	I		I		I		I		I		I	
I		I	ARM A	I	0.000	I	0.016	I	0.724	I	0.259	I	
I		I		I	0.0	I	3.0	I	134.0	I	48.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I	
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM C	I	0.854	I	0.038	I	0.000	I	0.108	I	
I		I		I	158.0	I	7.0	I	0.0	I	20.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM D	I	0.375	I	0.250	I	0.375	I	0.000	I	
I		I		I	3.0	I	2.0	I	3.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I	16.45 - 17.00	I		I		I		I		I		I	
I		I	ARM A	I	0.000	I	0.016	I	0.724	I	0.259	I	
I		I		I	0.0	I	3.0	I	134.0	I	48.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I	
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM C	I	0.854	I	0.038	I	0.000	I	0.108	I	
I		I		I	158.0	I	7.0	I	0.0	I	20.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM D	I	0.375	I	0.250	I	0.375	I	0.000	I	
I		I		I	3.0	I	2.0	I	3.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.00-16.15								
B-ACD	0.00	7.30	0.000		0.0	0.0	0.0	
A-BCD	1.04	11.83	0.088		0.0	0.1	1.9	
A-B	0.05							
A-C	2.14							
D-ABC	0.15	8.06	0.019		0.0	0.0	0.3	
C-ABD	0.16	12.21	0.013		0.0	0.0	0.2	
C-D	0.34							
C-A	2.72							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.15-16.30								
B-ACD	0.00	7.25	0.000		0.0	0.0	0.0	
A-BCD	1.11	11.86	0.093		0.1	0.1	2.0	
A-B	0.05							
A-C	2.23							
D-ABC	0.16	7.99	0.020		0.0	0.0	0.3	
C-ABD	0.17	12.27	0.014		0.0	0.0	0.2	
C-D	0.36							
C-A	2.86							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	16.30-16.45								
I	B-ACD	0.00	7.38	0.000		0.0	0.0	0.0	
I	A-BCD	0.93	11.76	0.079		0.1	0.1	1.7	
I	A-B	0.04							
I	A-C	1.96							
I	D-ABC	0.14	8.17	0.017		0.0	0.0	0.3	
I	C-ABD	0.14	12.10	0.012		0.0	0.0	0.2	
I	C-D	0.31							
I	C-A	2.47							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	16.45-17.00								
I	B-ACD	0.00	7.43	0.000		0.0	0.0	0.0	
I	A-BCD	0.87	11.72	0.074		0.1	0.1	1.5	
I	A-B	0.04							
I	A-C	1.86							
I	D-ABC	0.13	8.23	0.016		0.0	0.0	0.2	
I	C-ABD	0.13	12.05	0.011		0.0	0.0	0.2	
I	C-D	0.30							
I	C-A	2.34							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.1
16.30	0.1
16.45	0.1
17.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	59.2	I	59.2	I	7.1	I	7.1	I	0.12	I
I	A-B	I	2.8	I	2.8	I		I		I		I
I	A-C	I	122.8	I	122.8	I		I		I		I
I	D-ABC	I	8.7	I	8.7	I	1.1	I	1.1	I	0.13	I
I	C-ABD	I	9.2	I	9.2	I	0.8	I	0.8	I	0.09	I
I	C-D	I	19.7	I	19.7	I		I		I		I
I	C-A	I	155.9	I	155.9	I		I		I		I
I	ALL	I	378.3	I	378.3	I	9.0	I	9.0	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY05.vpi" (drive-on-the-left) at 09:56:01 on Friday, 6 September
2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2046 Weekday AM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
11.00 - 11.15		ARM A	0.000	0.056	0.769	0.176						
			0.0	6.0	83.0	19.0						
			(0.0)	(0.0)	(4.8)	(10.5)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.886	0.041	0.000	0.073						
			109.0	5.0	0.0	9.0						
			(14.7)	(0.0)	(0.0)	(0.0)						
		ARM D	0.417	0.000	0.583	0.000						
			5.0	0.0	7.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

11.15 - 11.30	ARM A	0.000	0.056	0.769	0.176
		0.0	6.0	83.0	19.0
		(0.0)	(0.0)	(4.8)	(10.5)
	ARM B	0.000	0.000	0.000	0.000
		I???????	I???????	I???????	I???????
		(0.0)	(0.0)	(0.0)	(0.0)
	ARM C	0.886	0.041	0.000	0.073
		109.0	5.0	0.0	9.0
		(14.7)	(0.0)	(0.0)	(0.0)
	ARM D	0.417	0.000	0.583	0.000
		5.0	0.0	7.0	0.0
		(0.0)	(0.0)	(0.0)	(0.0)

TURNING PROPORTIONS	
TURNING COUNTS	
(PERCENTAGE OF H.V.S)	
TIME	FROM/TO
11.30 - 11.45	ARM A
	ARM B
	ARM C
	ARM D
11.45 - 12.00	ARM A
	ARM B
	ARM C
	ARM D

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.00	7.67	0.000		0.0	0.0	0.0	
A-BCD	0.33	10.45	0.031		0.0	0.0	0.6	
A-B	0.09							
A-C	1.21							
D-ABC	0.18	8.64	0.021		0.0	0.0	0.3	
C-ABD	0.09	11.69	0.008		0.0	0.0	0.1	
C-D	0.13							
C-A	1.63							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.00	7.64	0.000		0.0	0.0	0.0	
A-BCD	0.35	10.47	0.033		0.0	0.0	0.6	
A-B	0.09							
A-C	1.27							
D-ABC	0.19	8.60	0.022		0.0	0.0	0.3	
C-ABD	0.09	11.73	0.008		0.0	0.0	0.1	
C-D	0.14							
C-A	1.71							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I									
I	11.30-11.45								
I	B-ACD	0.00	7.59	0.000		0.0	0.0	0.0	
I	A-BCD	0.39	10.52	0.037		0.0	0.0	0.7	
I	A-B	0.10							
I	A-C	1.40							
I	D-ABC	0.21	8.53	0.025		0.0	0.0	0.4	
I	C-ABD	0.11	11.79	0.009		0.0	0.0	0.1	
I	C-D	0.16							
I	C-A	1.89							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I									
I	11.45-12.00								
I	B-ACD	0.00	7.56	0.000		0.0	0.0	0.0	
I	A-BCD	0.41	10.54	0.039		0.0	0.1	0.8	
I	A-B	0.11							
I	A-C	1.46							
I	D-ABC	0.22	8.49	0.026		0.0	0.0	0.4	
I	C-ABD	0.11	11.83	0.009		0.0	0.0	0.2	
I	C-D	0.16							
I	C-A	1.98							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	22.1	I	22.1	I	2.8	I	2.8	I	0.12	I
I	A-B	I	5.8	I	5.8	I		I		I		I
I	A-C	I	80.1	I	80.1	I		I		I		I
I	D-ABC	I	12.0	I	12.0	I	1.4	I	1.4	I	0.12	I
I	C-ABD	I	6.0	I	6.0	I	0.6	I	0.6	I	0.09	I
I	C-D	I	8.9	I	8.9	I		I		I		I
I	C-A	I	108.2	I	108.2	I		I		I		I
I	ALL	I	243.1	I	243.1	I	4.7	I	4.7	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
=====
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY06.vpi" (drive-on-the-left) at 10:01:57 on Friday, 6 September
2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2046 Weekday PM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 17.00 AND ENDS 18.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
17.00 - 17.15												
		ARM A	0.000	0.038	0.764	0.197						
			0.0	8.0	159.0	41.0						
			(0.0)	(0.0)	(6.9)	(0.0)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.892	0.025	0.000	0.083						
			140.0	4.0	0.0	13.0						
			(2.9)	(0.0)	(0.0)	(0.0)						
		ARM D	0.400	0.000	0.600	0.000						
			4.0	0.0	6.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	17.15 - 17.30	I	I	I	I	I	I					
I		I	ARM A	I	0.000	I	0.038	I	0.764	I	0.197	I
I		I		I	0.0	I	8.0	I	159.0	I	41.0	I
I		I		I	(0.0)	I	(0.0)	I	(6.9)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.892	I	0.025	I	0.000	I	0.083	I
I		I		I	140.0	I	4.0	I	0.0	I	13.0	I
I		I		I	(2.9)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.400	I	0.000	I	0.600	I	0.000	I
I		I		I	4.0	I	0.0	I	6.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D							
I	17.30 - 17.45	I	I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.038	I	0.764	I	0.197	I
I		I		I	0.0	I	8.0	I	159.0	I	41.0	I
I		I		I	(0.0)	I	(0.0)	I	(6.9)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.892	I	0.025	I	0.000	I	0.083	I
I		I		I	140.0	I	4.0	I	0.0	I	13.0	I
I		I		I	(2.9)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.400	I	0.000	I	0.600	I	0.000	I
I		I		I	4.0	I	0.0	I	6.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I	17.45 - 18.00	I	I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.038	I	0.764	I	0.197	I
I		I		I	0.0	I	8.0	I	159.0	I	41.0	I
I		I		I	(0.0)	I	(0.0)	I	(6.9)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.892	I	0.025	I	0.000	I	0.083	I
I		I		I	140.0	I	4.0	I	0.0	I	13.0	I
I		I		I	(2.9)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.400	I	0.000	I	0.600	I	0.000	I
I		I		I	4.0	I	0.0	I	6.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.00-17.15								
B-ACD	0.00	7.21	0.000		0.0	0.0	0.0	
A-BCD	0.93	12.21	0.076		0.0	0.1	1.7	
A-B	0.13							
A-C	2.58							
D-ABC	0.18	8.16	0.022		0.0	0.0	0.3	
C-ABD	0.09	11.79	0.008		0.0	0.0	0.1	
C-D	0.23							
C-A	2.43							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.15-17.30								
B-ACD	0.00	7.16	0.000		0.0	0.0	0.0	
A-BCD	0.99	12.27	0.081		0.1	0.1	1.9	
A-B	0.14							
A-C	2.69							
D-ABC	0.19	8.10	0.023		0.0	0.0	0.4	
C-ABD	0.10	11.82	0.008		0.0	0.0	0.1	
C-D	0.24							
C-A	2.55							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	17.30-17.45								
I	B-ACD	0.00	7.30	0.000		0.0	0.0	0.0	
I	A-BCD	0.83	12.10	0.068		0.1	0.1	1.5	
I	A-B	0.12							
I	A-C	2.36							
I	D-ABC	0.16	8.26	0.019		0.0	0.0	0.3	
I	C-ABD	0.08	11.71	0.007		0.0	0.0	0.1	
I	C-D	0.20							
I	C-A	2.21							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	17.45-18.00								
I	B-ACD	0.00	7.35	0.000		0.0	0.0	0.0	
I	A-BCD	0.77	12.04	0.064		0.1	0.1	1.4	
I	A-B	0.11							
I	A-C	2.24							
I	D-ABC	0.15	8.32	0.018		0.0	0.0	0.3	
I	C-ABD	0.07	11.68	0.006		0.0	0.0	0.1	
I	C-D	0.19							
I	C-A	2.09							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.1
17.30	0.1
17.45	0.1
18.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	52.8	I	52.8	I	6.6	I	6.6	I	0.12	I
I	A-B	I	7.4	I	7.4	I		I		I		I
I	A-C	I	147.9	I	147.9	I		I		I		I
I	D-ABC	I	10.2	I	10.2	I	1.3	I	1.3	I	0.12	I
I	C-ABD	I	5.1	I	5.1	I	0.5	I	0.5	I	0.09	I
I	C-D	I	12.9	I	12.9	I		I		I		I
I	C-A	I	139.2	I	139.2	I		I		I		I
I	ALL	I	375.6	I	375.6	I	8.3	I	8.3	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
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Run with file:- "e:\21760PY07.vpi" (drive-on-the-left) at 10:07:25 on Friday, 6 September
2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2046 Weekend AM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS								
		TURNING COUNTS								
		(PERCENTAGE OF H.V.S)								
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D				
11.00 - 11.15		ARM A	0.000	0.026	0.716	0.258				
			0.0	4.0	111.0	40.0				
			(0.0)	(0.0)	(0.1)	(0.0)				
		ARM B	0.000	0.000	0.000	0.000				
			I???????	I???????	I???????	I???????				
			(0.0)	(0.0)	(0.0)	(0.0)				
		ARM C	0.931	0.013	0.000	0.057				
			148.0	2.0	0.0	9.0				
			(0.1)	(0.0)	(0.0)	(0.0)				
		ARM D	0.167	0.667	0.167	0.000				
			1.0	4.0	1.0	0.0				
			(0.0)	(0.0)	(0.0)	(0.0)				

11.15 - 11.30	ARM A	0.000	0.026	0.716	0.258
		0.0	4.0	111.0	40.0
		(0.0)	(0.0)	(0.1)	(0.0)
	ARM B	0.000	0.000	0.000	0.000
		I???????	I???????	I???????	I???????
		(0.0)	(0.0)	(0.0)	(0.0)
	ARM C	0.931	0.013	0.000	0.057
		148.0	2.0	0.0	9.0
		(0.1)	(0.0)	(0.0)	(0.0)
	ARM D	0.167	0.667	0.167	0.000
		1.0	4.0	1.0	0.0
		(0.0)	(0.0)	(0.0)	(0.0)

TURNING PROPORTIONS	
TURNING COUNTS	
(PERCENTAGE OF H.V.S)	
TIME	FROM/TO
11.30 - 11.45	ARM A
	ARM B
	ARM C
	ARM D
11.45 - 12.00	ARM A
	ARM B
	ARM C
	ARM D

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.00	7.54	0.000		0.0	0.0	0.0	
A-BCD	0.70	11.61	0.061		0.0	0.1	1.2	
A-B	0.06							
A-C	1.57							
D-ABC	0.09	7.92	0.011		0.0	0.0	0.2	
C-ABD	0.04	11.97	0.003		0.0	0.0	0.0	
C-D	0.13							
C-A	2.22							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.00	7.51	0.000		0.0	0.0	0.0	
A-BCD	0.75	11.64	0.064		0.1	0.1	1.3	
A-B	0.06							
A-C	1.64							
D-ABC	0.10	7.86	0.013		0.0	0.0	0.2	
C-ABD	0.04	12.02	0.003		0.0	0.0	0.1	
C-D	0.14							
C-A	2.34							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	11.30-11.45								
I									
I	B-ACD	0.00	7.44	0.000		0.0	0.0	0.0	
I									
I	A-BCD	0.84	11.70	0.072		0.1	0.1	1.5	
I									
I	A-B	0.07							
I									
I	A-C	1.80							
I									
I	D-ABC	0.11	7.75	0.014		0.0	0.0	0.2	
I									
I	C-ABD	0.04	12.12	0.004		0.0	0.0	0.1	
I									
I	C-D	0.16							
I									
I	C-A	2.58							
I									
I									
I									

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	11.45-12.00								
I									
I	B-ACD	0.00	7.40	0.000		0.0	0.0	0.0	
I									
I	A-BCD	0.89	11.73	0.076		0.1	0.1	1.6	
I									
I	A-B	0.07							
I									
I	A-C	1.88							
I									
I	D-ABC	0.12	7.70	0.016		0.0	0.0	0.2	
I									
I	C-ABD	0.05	12.17	0.004		0.0	0.0	0.1	
I									
I	C-D	0.16							
I									
I	C-A	2.71							
I									
I									
I									

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I				
I		I		I	* DELAY *	I	* DELAY *	I				
I		I		I		I		I				
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I		
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I
I	A-BCD	I	47.7	I	47.7	I	5.5	I	5.5	I	0.12	I
I	A-B	I	3.7	I	3.7	I		I		I		I
I	A-C	I	103.5	I	103.5	I		I		I		I
I	D-ABC	I	6.3	I	6.3	I	0.8	I	0.8	I	0.13	I
I	C-ABD	I	2.5	I	2.5	I	0.2	I	0.2	I	0.09	I
I	C-D	I	9.0	I	9.0	I		I		I		I
I	C-A	I	147.6	I	147.6	I		I		I		I
I	ALL	I	320.4	I	320.4	I	6.5	I	6.5	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
=====
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY08.vpi" (drive-on-the-left) at 10:11:36 on Friday, 6 September
2024

RUN TITLE

L352/L4034 Harbour Road/L4032 - 2046 Weekend PM Peak Hour With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 West
ARM B IS L3034 Harbour Road
ARM C IS R352 East
ARM D IS L4032

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.00 M.	I	(W) 6.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 160.0 M.	I	(VA-D) 160.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 60.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 60.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.20 M.	I	(WD-A) 2.35 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.00 AND ENDS 17.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
16.00 - 16.15		ARM A	0.000	0.021	0.718	0.262						
			0.0	4.0	140.0	51.0						
			(0.0)	(0.0)	(0.1)	(0.0)						
		ARM B	0.000	0.000	0.000	0.000						
			I???????	I???????	I???????	I???????						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.856	0.036	0.000	0.108						
			166.0	7.0	0.0	21.0						
			(0.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.400	0.200	0.400	0.000						
			4.0	2.0	4.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	16.15 - 16.30	I	I	I	I	I	I					
I		I	ARM A	I	0.000	I	0.021	I	0.718	I	0.262	I
I		I		I	0.0	I	4.0	I	140.0	I	51.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.856	I	0.036	I	0.000	I	0.108	I
I		I		I	166.0	I	7.0	I	0.0	I	21.0	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.400	I	0.200	I	0.400	I	0.000	I
I		I		I	4.0	I	2.0	I	4.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	
I	16.30 - 16.45	I		I	I	I	I	I	I	I	I	I	
I		I	ARM A	I	0.000	I	0.021	I	0.718	I	0.262	I	
I		I		I	0.0	I	4.0	I	140.0	I	51.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I	
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM C	I	0.856	I	0.036	I	0.000	I	0.108	I	
I		I		I	166.0	I	7.0	I	0.0	I	21.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM D	I	0.400	I	0.200	I	0.400	I	0.000	I	
I		I		I	4.0	I	2.0	I	4.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I	16.45 - 17.00	I		I	I	I	I	I	I	I	I	I	
I		I	ARM A	I	0.000	I	0.021	I	0.718	I	0.262	I	
I		I		I	0.0	I	4.0	I	140.0	I	51.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM B	I	0.000	I	0.000	I	0.000	I	0.000	I	
I		I		I	I???????	I	I???????	I	I???????	I	I???????	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM C	I	0.856	I	0.036	I	0.000	I	0.108	I	
I		I		I	166.0	I	7.0	I	0.0	I	21.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM D	I	0.400	I	0.200	I	0.400	I	0.000	I	
I		I		I	4.0	I	2.0	I	4.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.00-16.15								
B-ACD	0.00	7.25	0.000		0.0	0.0	0.0	
A-BCD	1.12	11.87	0.095		0.0	0.1	2.0	
A-B	0.06							
A-C	2.22							
D-ABC	0.18	8.05	0.022		0.0	0.0	0.3	
C-ABD	0.16	12.28	0.013		0.0	0.0	0.2	
C-D	0.36							
C-A	2.87							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.15-16.30								
B-ACD	0.00	7.21	0.000		0.0	0.0	0.0	
A-BCD	1.19	11.91	0.100		0.1	0.1	2.2	
A-B	0.07							
A-C	2.32							
D-ABC	0.19	7.99	0.024		0.0	0.0	0.4	
C-ABD	0.17	12.32	0.014		0.0	0.0	0.2	
C-D	0.38							
C-A	3.00							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	16.30-16.45								
I	B-ACD	0.00	7.34	0.000		0.0	0.0	0.0	
I	A-BCD	1.00	11.79	0.085		0.1	0.1	1.8	
I	A-B	0.06							
I	A-C	2.03							
I	D-ABC	0.17	8.17	0.021		0.0	0.0	0.3	
I	C-ABD	0.14	12.15	0.012		0.0	0.0	0.2	
I	C-D	0.33							
I	C-A	2.60							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	16.45-17.00								
I	B-ACD	0.00	7.38	0.000		0.0	0.0	0.0	
I	A-BCD	0.94	11.76	0.080		0.1	0.1	1.7	
I	A-B	0.06							
I	A-C	1.94							
I	D-ABC	0.16	8.23	0.019		0.0	0.0	0.3	
I	C-ABD	0.14	12.10	0.011		0.0	0.0	0.2	
I	C-D	0.31							
I	C-A	2.46							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.1
16.30	0.1
16.45	0.1
17.00	0.1

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I						
I		I		I	* DELAY *	I	* DELAY *	I						
I		I		I		I		I						
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I				
I	B-ACD	I	0.0	I	0.0	I	0.00	I	0.0	I	0.00	I		
I	A-BCD	I	63.7	I	63.7	I	7.7	I	0.12	I	7.7	I	0.12	I
I	A-B	I	3.7	I	3.7	I		I		I		I		I
I	A-C	I	127.8	I	127.8	I		I		I		I		I
I	D-ABC	I	10.5	I	10.5	I	1.3	I	0.13	I	1.3	I	0.13	I
I	C-ABD	I	9.3	I	9.3	I	0.9	I	0.09	I	0.9	I	0.09	I
I	C-D	I	20.7	I	20.7	I		I		I		I		I
I	C-A	I	163.9	I	163.9	I		I		I		I		I
I	ALL	I	399.6	I	399.6	I	9.9	I	0.02	I	9.9	I	0.02	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY09.vpi" (drive-on-the-left) at 10:21:55 on Friday, 6 September
2024

RUN TITLE

L352 Main Street/L4034 Harbour Rd/L8078 - 2032 Weekday AM Pk Hr With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 Main Street West
ARM B IS L8078
ARM C IS R352 Main Street East
ARM D IS L4034 Harbour Road

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
11.00 - 11.15		ARM A	0.000	0.000	0.896	0.104						
			0.0	0.0	60.0	7.0						
			(0.0)	(0.0)	(5.0)	(0.0)						
		ARM B	0.500	0.000	0.333	0.167						
			3.0	0.0	2.0	1.0						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.895	0.021	0.000	0.084						
			85.0	2.0	0.0	8.0						
			(14.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.636	0.061	0.303	0.000						
			21.0	2.0	10.0	0.0						
			(4.8)	(0.0)	(0.0)	(0.0)						

I	11.15 - 11.30	I		I		I		I		I		I
I		I	ARM A	I	0.000	I	0.000	I	0.896	I	0.104	I
I		I		I	0.0	I	0.0	I	60.0	I	7.0	I
I		I		I	(0.0)	I	(0.0)	I	(5.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.500	I	0.000	I	0.333	I	0.167	I
I		I		I	3.0	I	0.0	I	2.0	I	1.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.895	I	0.021	I	0.000	I	0.084	I
I		I		I	85.0	I	2.0	I	0.0	I	8.0	I
I		I		I	(14.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.636	I	0.061	I	0.303	I	0.000	I
I		I		I	21.0	I	2.0	I	10.0	I	0.0	I
I		I		I	(4.8)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	I
I	11.30 - 11.45	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.896	I	0.104	I	I
I		I		I	0.0	I	0.0	I	60.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(5.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.500	I	0.000	I	0.333	I	0.167	I	I
I		I		I	3.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.895	I	0.021	I	0.000	I	0.084	I	I
I		I		I	85.0	I	2.0	I	0.0	I	8.0	I	I
I		I		I	(14.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.636	I	0.061	I	0.303	I	0.000	I	I
I		I		I	21.0	I	2.0	I	10.0	I	0.0	I	I
I		I		I	(4.8)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I	11.45 - 12.00	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.896	I	0.104	I	I
I		I		I	0.0	I	0.0	I	60.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(5.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.500	I	0.000	I	0.333	I	0.167	I	I
I		I		I	3.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.895	I	0.021	I	0.000	I	0.084	I	I
I		I		I	85.0	I	2.0	I	0.0	I	8.0	I	I
I		I		I	(14.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.636	I	0.061	I	0.303	I	0.000	I	I
I		I		I	21.0	I	2.0	I	10.0	I	0.0	I	I
I		I		I	(4.8)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.09	9.27	0.010		0.0	0.0	0.1	
A-BCD	0.11	10.91	0.011		0.0	0.0	0.2	
A-B	0.00							
A-C	0.90							
D-ABC	0.50	9.66	0.052		0.0	0.1	0.8	
C-ABD	0.03	11.31	0.003		0.0	0.0	0.0	
C-D	0.12							
C-A	1.28							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.10	9.25	0.011		0.0	0.0	0.2	
A-BCD	0.12	10.93	0.011		0.0	0.0	0.2	
A-B	0.00							
A-C	0.95							
D-ABC	0.52	9.64	0.054		0.1	0.1	0.8	
C-ABD	0.04	11.34	0.003		0.0	0.0	0.0	
C-D	0.13							
C-A	1.34							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	11.30-11.45								
I									
I	B-ACD	0.11	9.19	0.012		0.0	0.0	0.2	
I									
I	A-BCD	0.14	10.95	0.012		0.0	0.0	0.2	
I									
I	A-B	0.00							
I									
I	A-C	1.04							
I									
I	D-ABC	0.58	9.59	0.060		0.1	0.1	0.9	
I									
I	C-ABD	0.04	11.41	0.004		0.0	0.0	0.1	
I									
I	C-D	0.14							
I									
I	C-A	1.48							
I									
I									
I									

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	11.45-12.00								
I									
I	B-ACD	0.12	9.16	0.013		0.0	0.0	0.2	
I									
I	A-BCD	0.14	10.96	0.013		0.0	0.0	0.2	
I									
I	A-B	0.00							
I									
I	A-C	1.09							
I									
I	D-ABC	0.61	9.56	0.064		0.1	0.1	1.0	
I									
I	C-ABD	0.04	11.44	0.004		0.0	0.0	0.1	
I									
I	C-D	0.15							
I									
I	C-A	1.55							
I									
I									
I									

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	6.3	I	6.3	I	0.7	I	0.11	I
I	A-BCD	I	7.7	I	7.7	I	0.8	I	0.10	I
I	A-B	I	0.0	I	0.0	I		I		I
I	A-C	I	59.6	I	59.6	I		I		I
I	D-ABC	I	33.2	I	33.2	I	3.6	I	0.11	I
I	C-ABD	I	2.3	I	2.3	I	0.2	I	0.09	I
I	C-D	I	8.0	I	8.0	I		I		I
I	C-A	I	84.7	I	84.7	I		I		I
I	ALL	I	201.8	I	201.8	I	5.3	I	0.03	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB


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***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY10.vpi" (drive-on-the-left) at 10:35:44 on Friday, 6 September
2024

RUN TITLE

L352 Main Street/L4034 Harbour Rd/L8078 - 2032 Weekday PM Pk Hr With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 Main Street West
ARM B IS L8078
ARM C IS R352 Main Street East
ARM D IS L4034 Harbour Road

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 17.00 AND ENDS 18.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
17.00 - 17.15		ARM A	0.000	0.000	0.950	0.050						
			0.0	0.0	134.0	7.0						
			(0.0)	(0.0)	(3.0)	(0.0)						
		ARM B	0.813	0.000	0.125	0.063						
			13.0	0.0	2.0	1.0						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.835	0.019	0.000	0.146						
			86.0	2.0	0.0	15.0						
			(3.5)	(0.0)	(0.0)	(0.0)						
		ARM D	0.634	0.028	0.338	0.000						
			45.0	2.0	24.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	17.15 - 17.30	I		I		I		I		I		I
I		I	ARM A	I	0.000	I	0.000	I	0.950	I	0.050	I
I		I		I	0.0	I	0.0	I	134.0	I	7.0	I
I		I		I	(0.0)	I	(0.0)	I	(3.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.813	I	0.000	I	0.125	I	0.063	I
I		I		I	13.0	I	0.0	I	2.0	I	1.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.835	I	0.019	I	0.000	I	0.146	I
I		I		I	86.0	I	2.0	I	0.0	I	15.0	I
I		I		I	(3.5)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.634	I	0.028	I	0.338	I	0.000	I
I		I		I	45.0	I	2.0	I	24.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	I
I	17.30 - 17.45	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.950	I	0.050	I	I
I		I		I	0.0	I	0.0	I	134.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(3.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.813	I	0.000	I	0.125	I	0.063	I	I
I		I		I	13.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.835	I	0.019	I	0.000	I	0.146	I	I
I		I		I	86.0	I	2.0	I	0.0	I	15.0	I	I
I		I		I	(3.5)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.634	I	0.028	I	0.338	I	0.000	I	I
I		I		I	45.0	I	2.0	I	24.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I	17.45 - 18.00	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.950	I	0.050	I	I
I		I		I	0.0	I	0.0	I	134.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(3.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.813	I	0.000	I	0.125	I	0.063	I	I
I		I		I	13.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.835	I	0.019	I	0.000	I	0.146	I	I
I		I		I	86.0	I	2.0	I	0.0	I	15.0	I	I
I		I		I	(3.5)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.634	I	0.028	I	0.338	I	0.000	I	I
I		I		I	45.0	I	2.0	I	24.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.00-17.15								
B-ACD	0.28	8.31	0.034		0.0	0.0	0.5	
A-BCD	0.15	11.79	0.013		0.0	0.0	0.2	
A-B	0.00							
A-C	2.32							
D-ABC	1.24	9.76	0.127		0.0	0.1	2.1	
C-ABD	0.04	11.26	0.004		0.0	0.0	0.1	
C-D	0.26							
C-A	1.50							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.15-17.30								
B-ACD	0.30	8.26	0.036		0.0	0.0	0.6	
A-BCD	0.16	11.84	0.014		0.0	0.0	0.2	
A-B	0.00							
A-C	2.43							
D-ABC	1.30	9.73	0.134		0.1	0.2	2.3	
C-ABD	0.04	11.28	0.004		0.0	0.0	0.1	
C-D	0.27							
C-A	1.57							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	17.30-17.45								
I	B-ACD	0.26	8.41	0.031		0.0	0.0	0.5	
I	A-BCD	0.13	11.68	0.012		0.0	0.0	0.2	
I	A-B	0.00							
I	A-C	2.10							
I	D-ABC	1.12	9.82	0.114		0.2	0.1	2.0	
I	C-ABD	0.04	11.21	0.003		0.0	0.0	0.1	
I	C-D	0.24							
I	C-A	1.36							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	17.45-18.00								
I	B-ACD	0.24	8.46	0.028		0.0	0.0	0.4	
I	A-BCD	0.13	11.64	0.011		0.0	0.0	0.2	
I	A-B	0.00							
I	A-C	1.99							
I	D-ABC	1.06	9.85	0.108		0.1	0.1	1.8	
I	C-ABD	0.03	11.18	0.003		0.0	0.0	0.0	
I	C-D	0.23							
I	C-A	1.29							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.1
17.30	0.2
17.45	0.1
18.00	0.1

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	16.2	I	16.2	I	2.0	I	0.12	I
I	A-BCD	I	8.6	I	8.6	I	0.8	I	0.10	I
I	A-B	I	0.0	I	0.0	I		I		I
I	A-C	I	132.5	I	132.5	I		I		I
I	D-ABC	I	70.8	I	70.8	I	8.2	I	0.12	I
I	C-ABD	I	2.4	I	2.4	I	0.2	I	0.09	I
I	C-D	I	15.0	I	15.0	I		I		I
I	C-A	I	85.9	I	85.9	I		I		I
I	ALL	I	331.4	I	331.4	I	11.2	I	0.03	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
=====
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY11.vpi" (drive-on-the-left) at 10:41:30 on Friday, 6 September
2024

RUN TITLE

L352 Main Street/L4034 Harbour Rd/L8078 - 2032 Weekend AM Pk Hr With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 Main Street West
ARM B IS L8078
ARM C IS R352 Main Street East
ARM D IS L4034 Harbour Road

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
11.00 - 11.15		ARM A	0.000	0.056	0.789	0.156						
			0.0	5.0	71.0	14.0						
			(0.0)	(0.0)	(0.1)	(0.0)						
		ARM B	0.786	0.000	0.214	0.000						
			11.0	0.0	3.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.887	0.016	0.000	0.097						
			110.0	2.0	0.0	12.0						
			(0.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.597	0.032	0.371	0.000						
			37.0	2.0	23.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	11.15 - 11.30	I		I		I		I		I		I
I		I	ARM A	I	0.000	I	0.056	I	0.789	I	0.156	I
I		I		I	0.0	I	5.0	I	71.0	I	14.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.786	I	0.000	I	0.214	I	0.000	I
I		I		I	11.0	I	0.0	I	3.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.887	I	0.016	I	0.000	I	0.097	I
I		I		I	110.0	I	2.0	I	0.0	I	12.0	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.597	I	0.032	I	0.371	I	0.000	I
I		I		I	37.0	I	2.0	I	23.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	I
I	11.30 - 11.45	I		I		I		I		I		I	I
I		I	ARM A	I	0.000	I	0.056	I	0.789	I	0.156	I	I
I		I		I	0.0	I	5.0	I	71.0	I	14.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I		I	ARM B	I	0.786	I	0.000	I	0.214	I	0.000	I	I
I		I		I	11.0	I	0.0	I	3.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I		I	ARM C	I	0.887	I	0.016	I	0.000	I	0.097	I	I
I		I		I	110.0	I	2.0	I	0.0	I	12.0	I	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I		I	ARM D	I	0.597	I	0.032	I	0.371	I	0.000	I	I
I		I		I	37.0	I	2.0	I	23.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I	11.45 - 12.00	I		I		I		I		I		I	I
I		I	ARM A	I	0.000	I	0.056	I	0.789	I	0.156	I	I
I		I		I	0.0	I	5.0	I	71.0	I	14.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I		I	ARM B	I	0.733	I	0.000	I	0.200	I	0.067	I	I
I		I		I	11.0	I	0.0	I	3.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I		I	ARM C	I	0.887	I	0.016	I	0.000	I	0.097	I	I
I		I		I	110.0	I	2.0	I	0.0	I	12.0	I	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I		I		I		I		I	I
I		I	ARM D	I	0.597	I	0.032	I	0.371	I	0.000	I	I
I		I		I	37.0	I	2.0	I	23.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I		I		I		I		I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.21	8.85	0.024		0.0	0.0	0.4	
A-BCD	0.23	11.03	0.021		0.0	0.0	0.4	
A-B	0.07							
A-C	1.04							
D-ABC	0.93	9.75	0.095		0.0	0.1	1.5	
C-ABD	0.04	11.57	0.003		0.0	0.0	0.0	
C-D	0.18							
C-A	1.65							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.23	8.80	0.026		0.0	0.0	0.4	
A-BCD	0.25	11.04	0.023		0.0	0.0	0.4	
A-B	0.08							
A-C	1.10							
D-ABC	0.99	9.71	0.102		0.1	0.1	1.7	
C-ABD	0.04	11.62	0.003		0.0	0.0	0.1	
C-D	0.19							
C-A	1.74							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I									
SEGMENT) I									
I	11.30-11.45								
I									
I	B-ACD	0.25	8.73	0.029		0.0	0.0	0.4	
I									
I	A-BCD	0.28	11.08	0.025		0.0	0.0	0.5	
I									
I	A-B	0.09							
I									
I	A-C	1.22							
I									
I	D-ABC	1.09	9.65	0.113		0.1	0.1	1.9	
I									
I	C-ABD	0.04	11.71	0.004		0.0	0.0	0.1	
I									
I	C-D	0.21							
I									
I	C-A	1.92							
I									
I									
I									

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I									
SEGMENT) I									
I	11.45-12.00								
I									
I	B-ACD	0.27	8.67	0.031		0.0	0.0	0.5	
I									
I	A-BCD	0.29	11.09	0.026		0.0	0.0	0.5	
I									
I	A-B	0.09							
I									
I	A-C	1.27							
I									
I	D-ABC	1.15	9.61	0.120		0.1	0.1	2.0	
I									
I	C-ABD	0.05	11.77	0.004		0.0	0.0	0.1	
I									
I	C-D	0.22							
I									
I	C-A	2.01							
I									
I									
I									

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	14.4	I	14.4	I	1.7	I	0.11	I
I	A-BCD	I	15.8	I	15.8	I	1.8	I	0.11	I
I	A-B	I	4.9	I	4.9	I		I		I
I	A-C	I	69.4	I	69.4	I		I		I
I	D-ABC	I	62.4	I	62.4	I	7.1	I	0.11	I
I	C-ABD	I	2.4	I	2.4	I	0.2	I	0.09	I
I	C-D	I	12.0	I	12.0	I		I		I
I	C-A	I	109.8	I	109.8	I		I		I
I	ALL	I	291.1	I	291.1	I	10.7	I	0.04	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY12.vpi" (drive-on-the-left) at 10:46:50 on Friday, 6 September
2024

RUN TITLE

L352 Main Street/L4034 Harbour Rd/L8078 - 2032 Weekend PM Pk Hr With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 Main Street West
ARM B IS L8078
ARM C IS R352 Main Street East
ARM D IS L4034 Harbour Road

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.00 AND ENDS 17.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
16.00 - 16.15		ARM A	0.000	0.032	0.864	0.104						
			0.0	5.0	133.0	16.0						
			(0.0)	(0.0)	(0.1)	(0.0)						
		ARM B	0.600	0.000	0.300	0.100						
			6.0	0.0	3.0	1.0						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.862	0.007	0.000	0.130						
			119.0	1.0	0.0	18.0						
			(0.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.678	0.052	0.270	0.000						
			78.0	6.0	31.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	16.15 - 16.30	I	I	I	I	I	I					
I		I	ARM A	I	0.000	I	0.032	I	0.864	I	0.104	I
I		I		I	0.0	I	5.0	I	133.0	I	16.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.600	I	0.000	I	0.300	I	0.100	I
I		I		I	6.0	I	0.0	I	3.0	I	1.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.862	I	0.007	I	0.000	I	0.130	I
I		I		I	119.0	I	1.0	I	0.0	I	18.0	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.678	I	0.052	I	0.270	I	0.000	I
I		I		I	78.0	I	6.0	I	31.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	
I	16.30 - 16.45	I		I		I		I		I		I	
I		I	ARM A	I	0.000	I	0.032	I	0.864	I	0.104	I	
I		I		I	0.0	I	5.0	I	133.0	I	16.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM B	I	0.600	I	0.000	I	0.300	I	0.100	I	
I		I		I	6.0	I	0.0	I	3.0	I	1.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM C	I	0.862	I	0.007	I	0.000	I	0.130	I	
I		I		I	119.0	I	1.0	I	0.0	I	18.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM D	I	0.678	I	0.052	I	0.270	I	0.000	I	
I		I		I	78.0	I	6.0	I	31.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I	16.45 - 17.00	I		I		I		I		I		I	
I		I	ARM A	I	0.000	I	0.032	I	0.864	I	0.104	I	
I		I		I	0.0	I	5.0	I	133.0	I	16.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM B	I	0.600	I	0.000	I	0.300	I	0.100	I	
I		I		I	6.0	I	0.0	I	3.0	I	1.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM C	I	0.862	I	0.007	I	0.000	I	0.130	I	
I		I		I	119.0	I	1.0	I	0.0	I	18.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	
I		I	ARM D	I	0.678	I	0.052	I	0.270	I	0.000	I	
I		I		I	78.0	I	6.0	I	31.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I		I		I		I		I	

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.00-16.15								
B-ACD	0.18	8.51	0.021		0.0	0.0	0.3	
A-BCD	0.35	11.74	0.030		0.0	0.0	0.6	
A-B	0.09							
A-C	2.26							
D-ABC	2.01	9.73	0.207		0.0	0.3	3.7	
C-ABD	0.02	11.64	0.002		0.0	0.0	0.0	
C-D	0.32							
C-A	2.08							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.15-16.30								
B-ACD	0.19	8.45	0.022		0.0	0.0	0.3	
A-BCD	0.37	11.79	0.032		0.0	0.0	0.6	
A-B	0.09							
A-C	2.37							
D-ABC	2.11	9.70	0.218		0.3	0.3	4.1	
C-ABD	0.02	11.68	0.002		0.0	0.0	0.0	
C-D	0.33							
C-A	2.18							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	16.30-16.45								
I	B-ACD	0.17	8.62	0.020		0.0	0.0	0.3	
I	A-BCD	0.31	11.64	0.027		0.0	0.0	0.5	
I	A-B	0.08							
I	A-C	2.05							
I	D-ABC	1.83	9.81	0.187		0.3	0.2	3.5	
I	C-ABD	0.02	11.55	0.002		0.0	0.0	0.0	
I	C-D	0.29							
I	C-A	1.89							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	16.45-17.00								
I	B-ACD	0.16	8.68	0.018		0.0	0.0	0.3	
I	A-BCD	0.29	11.59	0.025		0.0	0.0	0.5	
I	A-B	0.07							
I	A-C	1.95							
I	D-ABC	1.73	9.84	0.176		0.2	0.2	3.3	
I	C-ABD	0.02	11.50	0.002		0.0	0.0	0.0	
I	C-D	0.27							
I	C-A	1.78							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.3
16.30	0.3
16.45	0.2
17.00	0.2

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	10.5	I	10.5	I	1.2	I	0.12	I
I	A-BCD	I	19.9	I	19.9	I	2.2	I	0.11	I
I	A-B	I	4.9	I	4.9	I		I		I
I	A-C	I	129.5	I	129.5	I		I		I
I	D-ABC	I	115.2	I	115.2	I	14.6	I	0.13	I
I	C-ABD	I	1.2	I	1.2	I	0.1	I	0.09	I
I	C-D	I	18.0	I	18.0	I		I		I
I	C-A	I	118.9	I	118.9	I		I		I
I	ALL	I	418.0	I	418.0	I	18.2	I	0.04	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
=====
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
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Run with file:- "e:\21760PY13.vpi" (drive-on-the-left) at 10:52:03 on Friday, 6 September
2024

RUN TITLE

L352 Main Street/L4034 Harbour Rd/L8078 - 2046 Weekday AM Pk Hr With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 Main Street West
ARM B IS L8078
ARM C IS R352 Main Street East
ARM D IS L4034 Harbour Road

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS									
		TURNING COUNTS									
		(PERCENTAGE OF H.V.S)									
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D					
11.00 - 11.15		ARM A	0.000 0.0 (0.0)	0.000 0.0 (0.0)	0.901 64.0 (6.3)	0.099 7.0 (0.0)					
		ARM B	0.571 4.0 (0.0)	0.000 0.0 (0.0)	0.286 2.0 (0.0)	0.143 1.0 (0.0)					
		ARM C	0.903 93.0 (17.2)	0.019 2.0 (0.0)	0.000 0.0 (0.0)	0.078 8.0 (0.0)					
		ARM D	0.639 23.0 (8.7)	0.056 2.0 (0.0)	0.306 11.0 (0.0)	0.000 0.0 (0.0)					

I	11.15 - 11.30	I		I		I		I		I		I
I		I	ARM A	I	0.000	I	0.000	I	0.901	I	0.099	I
I		I		I	0.0	I	0.0	I	64.0	I	7.0	I
I		I		I	(0.0)	I	(0.0)	I	(6.3)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.571	I	0.000	I	0.286	I	0.143	I
I		I		I	4.0	I	0.0	I	2.0	I	1.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.903	I	0.019	I	0.000	I	0.078	I
I		I		I	93.0	I	2.0	I	0.0	I	8.0	I
I		I		I	(17.2)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.639	I	0.056	I	0.306	I	0.000	I
I		I		I	23.0	I	2.0	I	11.0	I	0.0	I
I		I		I	(8.7)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	I
I	11.30 - 11.45	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.901	I	0.099	I	I
I		I		I	0.0	I	0.0	I	64.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(6.3)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.571	I	0.000	I	0.286	I	0.143	I	I
I		I		I	4.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.903	I	0.019	I	0.000	I	0.078	I	I
I		I		I	93.0	I	2.0	I	0.0	I	8.0	I	I
I		I		I	(17.2)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.639	I	0.056	I	0.306	I	0.000	I	I
I		I		I	23.0	I	2.0	I	11.0	I	0.0	I	I
I		I		I	(8.7)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I	11.45 - 12.00	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.901	I	0.099	I	I
I		I		I	0.0	I	0.0	I	64.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(6.3)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.571	I	0.000	I	0.286	I	0.143	I	I
I		I		I	4.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.903	I	0.019	I	0.000	I	0.078	I	I
I		I		I	93.0	I	2.0	I	0.0	I	8.0	I	I
I		I		I	(17.2)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.639	I	0.056	I	0.306	I	0.000	I	I
I		I		I	23.0	I	2.0	I	11.0	I	0.0	I	I
I		I		I	(8.7)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.11	9.12	0.012		0.0	0.0	0.2	
A-BCD	0.12	10.91	0.011		0.0	0.0	0.2	
A-B	0.00							
A-C	0.95							
D-ABC	0.54	9.41	0.057		0.0	0.1	0.9	
C-ABD	0.03	11.35	0.003		0.0	0.0	0.0	
C-D	0.12							
C-A	1.40							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.12	9.09	0.013		0.0	0.0	0.2	
A-BCD	0.12	10.91	0.011		0.0	0.0	0.2	
A-B	0.00							
A-C	1.00							
D-ABC	0.57	9.38	0.061		0.1	0.1	1.0	
C-ABD	0.04	11.39	0.003		0.0	0.0	0.1	
C-D	0.13							
C-A	1.48							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	11.30-11.45								
I	B-ACD	0.13	9.02	0.014		0.0	0.0	0.2	
I	A-BCD	0.14	10.93	0.012		0.0	0.0	0.2	
I	A-B	0.00							
I	A-C	1.10							
I	D-ABC	0.63	9.33	0.068		0.1	0.1	1.1	
I	C-ABD	0.04	11.46	0.004		0.0	0.0	0.1	
I	C-D	0.14							
I	C-A	1.63							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	11.45-12.00								
I	B-ACD	0.14	8.99	0.016		0.0	0.0	0.2	
I	A-BCD	0.14	10.95	0.013		0.0	0.0	0.2	
I	A-B	0.00							
I	A-C	1.16							
I	D-ABC	0.66	9.30	0.071		0.1	0.1	1.1	
I	C-ABD	0.04	11.49	0.004		0.0	0.0	0.1	
I	C-D	0.15							
I	C-A	1.70							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	7.5	I	7.5	I	0.8	I	0.11	I
I	A-BCD	I	7.7	I	7.7	I	0.8	I	0.10	I
I	A-B	I	0.0	I	0.0	I		I		I
I	A-C	I	63.2	I	63.2	I		I		I
I	D-ABC	I	36.0	I	36.0	I	4.0	I	0.11	I
I	C-ABD	I	2.3	I	2.3	I	0.2	I	0.09	I
I	C-D	I	8.0	I	8.0	I		I		I
I	C-A	I	93.0	I	93.0	I		I		I
I	ALL	I	217.8	I	217.8	I	5.8	I	0.03	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

```
***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
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Run with file:- "e:\21760PY14.vpi" (drive-on-the-left) at 10:56:56 on Friday, 6 September
2024

RUN TITLE

L352 Main Street/L4034 Harbour Rd/L8078 - 2046 Weekday PM Pk Hr With TII Growth

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

```

                                MINOR ROAD (ARM D)
                                I
                                I
                                I
                                I
                                I
                                I
                                I
MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
                                I
                                I
                                I
                                I
                                I
                                I
                                MINOR ROAD (ARM B)

```

ARM A IS R352 Main Street West
ARM B IS L8078
ARM C IS R352 Main Street East
ARM D IS L4034 Harbour Road

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 17.00 AND ENDS 18.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
17.00 - 17.15		ARM A	0.000	0.000	0.953	0.047						
			0.0	0.0	142.0	7.0						
			(0.0)	(0.0)	(3.5)	(0.0)						
		ARM B	0.833	0.000	0.111	0.056						
			15.0	0.0	2.0	1.0						
			(2.7)	(0.0)	(0.0)	(0.0)						
		ARM C	0.843	0.019	0.000	0.139						
			91.0	2.0	0.0	15.0						
			(4.4)	(0.0)	(0.0)	(0.0)						
		ARM D	0.635	0.027	0.338	0.000						
			47.0	2.0	25.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	17.15 - 17.30	I		I		I		I		I		I
I		I	ARM A	I	0.000	I	0.000	I	0.953	I	0.047	I
I		I		I	0.0	I	0.0	I	142.0	I	7.0	I
I		I		I	(0.0)	I	(0.0)	I	(3.5)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.833	I	0.000	I	0.111	I	0.056	I
I		I		I	15.0	I	0.0	I	2.0	I	1.0	I
I		I		I	(2.7)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.843	I	0.019	I	0.000	I	0.139	I
I		I		I	91.0	I	2.0	I	0.0	I	15.0	I
I		I		I	(4.4)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.635	I	0.027	I	0.338	I	0.000	I
I		I		I	47.0	I	2.0	I	25.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	I
I	17.30 - 17.45	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.953	I	0.047	I	I
I		I		I	0.0	I	0.0	I	142.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(3.5)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.833	I	0.000	I	0.111	I	0.056	I	I
I		I		I	15.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(2.7)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.843	I	0.019	I	0.000	I	0.139	I	I
I		I		I	91.0	I	2.0	I	0.0	I	15.0	I	I
I		I		I	(4.4)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.635	I	0.027	I	0.338	I	0.000	I	I
I		I		I	47.0	I	2.0	I	25.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I	17.45 - 18.00	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.000	I	0.953	I	0.047	I	I
I		I		I	0.0	I	0.0	I	142.0	I	7.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(3.5)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.833	I	0.000	I	0.111	I	0.056	I	I
I		I		I	15.0	I	0.0	I	2.0	I	1.0	I	I
I		I		I	(2.7)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.843	I	0.019	I	0.000	I	0.139	I	I
I		I		I	91.0	I	2.0	I	0.0	I	15.0	I	I
I		I		I	(4.4)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.635	I	0.027	I	0.338	I	0.000	I	I
I		I		I	47.0	I	2.0	I	25.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.00-17.15								
B-ACD	0.32	8.03	0.040		0.0	0.0	0.6	
A-BCD	0.15	11.85	0.013		0.0	0.0	0.2	
A-B	0.00							
A-C	2.46							
D-ABC	1.29	9.72	0.133		0.0	0.2	2.2	
C-ABD	0.04	11.27	0.004		0.0	0.0	0.1	
C-D	0.26							
C-A	1.59							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
17.15-17.30								
B-ACD	0.33	7.98	0.041		0.0	0.0	0.6	
A-BCD	0.16	11.90	0.014		0.0	0.0	0.2	
A-B	0.00							
A-C	2.57							
D-ABC	1.35	9.69	0.139		0.2	0.2	2.4	
C-ABD	0.04	11.30	0.004		0.0	0.0	0.1	
C-D	0.27							
C-A	1.66							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	17.30-17.45								
I	B-ACD	0.29	8.14	0.036		0.0	0.0	0.6	
I	A-BCD	0.14	11.74	0.012		0.0	0.0	0.2	
I	A-B	0.00							
I	A-C	2.22							
I	D-ABC	1.17	9.79	0.120		0.2	0.1	2.1	
I	C-ABD	0.04	11.22	0.003		0.0	0.0	0.1	
I	C-D	0.24							
I	C-A	1.44							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
SEGMENT)	I								
I	17.45-18.00								
I	B-ACD	0.27	8.19	0.033		0.0	0.0	0.5	
I	A-BCD	0.13	11.68	0.011		0.0	0.0	0.2	
I	A-B	0.00							
I	A-C	2.10							
I	D-ABC	1.11	9.82	0.113		0.1	0.1	1.9	
I	C-ABD	0.03	11.19	0.003		0.0	0.0	0.0	
I	C-D	0.22							
I	C-A	1.36							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.2
17.30	0.2
17.45	0.1
18.00	0.1

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	18.1	I	18.1	I	2.3	I	0.13	I
I	A-BCD	I	8.7	I	8.7	I	0.8	I	0.10	I
I	A-B	I	0.0	I	0.0	I		I		I
I	A-C	I	140.2	I	140.2	I		I		I
I	D-ABC	I	73.8	I	73.8	I	8.6	I	0.12	I
I	C-ABD	I	2.4	I	2.4	I	0.2	I	0.09	I
I	C-D	I	14.9	I	14.9	I		I		I
I	C-A	I	90.7	I	90.7	I		I		I
I	ALL	I	348.9	I	348.9	I	12.0	I	0.03	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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***** PICADY 4 run completed.  
===== end of file  
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ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS									
		TURNING COUNTS									
		(PERCENTAGE OF H.V.S)									
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D					
11.00 - 11.15		ARM A	0.000	0.064	0.787	0.149					
			0.0	6.0	74.0	14.0					
			(0.0)	(0.0)	(0.1)	(0.0)					
		ARM B	0.750	0.000	0.250	0.000					
			12.0	0.0	4.0	0.0					
			(0.0)	(0.0)	(0.0)	(0.0)					
		ARM C	0.885	0.015	0.000	0.100					
			115.0	2.0	0.0	13.0					
			(0.1)	(0.0)	(0.0)	(0.0)					
		ARM D	0.600	0.031	0.369	0.000					
			39.0	2.0	24.0	0.0					
			(0.0)	(0.0)	(0.0)	(0.0)					

I	11.15 - 11.30	I		I		I		I		I		I
I		I	ARM A	I	0.000	I	0.064	I	0.787	I	0.149	I
I		I		I	0.0	I	6.0	I	74.0	I	14.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM B	I	0.750	I	0.000	I	0.250	I	0.000	I
I		I		I	12.0	I	0.0	I	4.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM C	I	0.885	I	0.015	I	0.000	I	0.100	I
I		I		I	115.0	I	2.0	I	0.0	I	13.0	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I
I		I	ARM D	I	0.600	I	0.031	I	0.369	I	0.000	I
I		I		I	39.0	I	2.0	I	24.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I		I		I		I		I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	I
I	11.30 - 11.45	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.064	I	0.787	I	0.149	I	I
I		I		I	0.0	I	6.0	I	74.0	I	14.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.750	I	0.000	I	0.250	I	0.000	I	I
I		I		I	12.0	I	0.0	I	4.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.885	I	0.015	I	0.000	I	0.100	I	I
I		I		I	115.0	I	2.0	I	0.0	I	13.0	I	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.600	I	0.031	I	0.369	I	0.000	I	I
I		I		I	39.0	I	2.0	I	24.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I	11.45 - 12.00	I		I	I	I	I	I	I	I	I	I	I
I		I	ARM A	I	0.000	I	0.064	I	0.787	I	0.149	I	I
I		I		I	0.0	I	6.0	I	74.0	I	14.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.750	I	0.000	I	0.250	I	0.000	I	I
I		I		I	12.0	I	0.0	I	4.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.885	I	0.015	I	0.000	I	0.100	I	I
I		I		I	115.0	I	2.0	I	0.0	I	13.0	I	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.600	I	0.031	I	0.369	I	0.000	I	I
I		I		I	39.0	I	2.0	I	24.0	I	0.0	I	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	I
I		I		I	I	I	I	I	I	I	I	I	I

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.00-11.15								
B-ACD	0.24	8.90	0.027		0.0	0.0	0.4	
A-BCD	0.24	11.04	0.021		0.0	0.0	0.4	
A-B	0.09							
A-C	1.09							
D-ABC	0.98	9.73	0.101		0.0	0.1	1.6	
C-ABD	0.04	11.62	0.003		0.0	0.0	0.0	
C-D	0.19							
C-A	1.72							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
11.15-11.30								
B-ACD	0.26	8.85	0.029		0.0	0.0	0.4	
A-BCD	0.25	11.06	0.023		0.0	0.0	0.4	
A-B	0.09							
A-C	1.15							
D-ABC	1.03	9.69	0.106		0.1	0.1	1.8	
C-ABD	0.04	11.67	0.003		0.0	0.0	0.1	
C-D	0.21							
C-A	1.82							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	11.30-11.45								
I									
I	B-ACD	0.28	8.77	0.032		0.0	0.0	0.5	
I									
I	A-BCD	0.28	11.10	0.025		0.0	0.0	0.5	
I									
I	A-B	0.10							
I									
I	A-C	1.27							
I									
I	D-ABC	1.14	9.63	0.118		0.1	0.1	2.0	
I									
I	C-ABD	0.04	11.77	0.004		0.0	0.0	0.1	
I									
I	C-D	0.23							
I									
I	C-A	2.01							
I									
I									
I									

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	11.45-12.00								
I									
I	B-ACD	0.30	8.73	0.034		0.0	0.0	0.5	
I									
I	A-BCD	0.30	11.12	0.027		0.0	0.0	0.5	
I									
I	A-B	0.11							
I									
I	A-C	1.33							
I									
I	D-ABC	1.19	9.59	0.124		0.1	0.1	2.1	
I									
I	C-ABD	0.05	11.82	0.004		0.0	0.0	0.1	
I									
I	C-D	0.24							
I									
I	C-A	2.11							
I									
I									
I									

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.1
11.30	0.1
11.45	0.1
12.00	0.1

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	16.2	I	16.2	I	1.9	I	0.11	I
I	A-BCD	I	15.9	I	15.9	I	1.8	I	0.11	I
I	A-B	I	5.9	I	5.9	I		I		I
I	A-C	I	72.4	I	72.4	I		I		I
I	D-ABC	I	65.1	I	65.1	I	7.4	I	0.11	I
I	C-ABD	I	2.4	I	2.4	I	0.2	I	0.09	I
I	C-D	I	13.0	I	13.0	I		I		I
I	C-A	I	114.8	I	114.8	I		I		I
I	ALL	I	305.7	I	305.7	I	11.3	I	0.04	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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***** PICADY 4 run completed.  
===== end of file  
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STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I	MINOR ROAD D	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 7.00 M.	I	(W) 7.00 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I	(WCR) 0.00 M.	I
I		I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I	(WA-D) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 120.0 M.	I	(VA-D) 120.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I	YES	I
I		I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 90.0 M.	I	(VD-A) 90.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 90.0 M.	I	(VD-C) 90.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 2.95 M.	I	(WD-A) 2.95 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I	(WD-C) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.00 AND ENDS 17.00

LENGTH OF TIME PERIOD - 60 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS										
		TURNING COUNTS										
		(PERCENTAGE OF H.V.S)										
TIME		FROM/TO	ARM A	ARM B	ARM C	ARM D						
16.00 - 16.15		ARM A	0.000	0.037	0.858	0.105						
			0.0	6.0	139.0	17.0						
			(0.0)	(0.0)	(0.1)	(0.0)						
		ARM B	0.545	0.000	0.364	0.091						
			6.0	0.0	4.0	1.0						
			(0.0)	(0.0)	(0.0)	(0.0)						
		ARM C	0.862	0.007	0.000	0.131						
			125.0	1.0	0.0	19.0						
			(0.1)	(0.0)	(0.0)	(0.0)						
		ARM D	0.675	0.050	0.275	0.000						
			81.0	6.0	33.0	0.0						
			(0.0)	(0.0)	(0.0)	(0.0)						

I	16.15 - 16.30	I	I	I	I	I	I					
I		I	ARM A	I	0.000	I	0.037	I	0.858	I	0.105	I
I		I		I	0.0	I	6.0	I	139.0	I	17.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM B	I	0.545	I	0.000	I	0.364	I	0.091	I
I		I		I	6.0	I	0.0	I	4.0	I	1.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM C	I	0.862	I	0.007	I	0.000	I	0.131	I
I		I		I	125.0	I	1.0	I	0.0	I	19.0	I
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I
I		I	ARM D	I	0.675	I	0.050	I	0.275	I	0.000	I
I		I		I	81.0	I	6.0	I	33.0	I	0.0	I
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I
I		I		I	I	I	I	I	I	I	I	I

I		I	TURNING PROPORTIONS										I
I		I	TURNING COUNTS										I
I		I	(PERCENTAGE OF H.V.S)										I
I		I											I
I	TIME	I	FROM/TO	I	ARM A	I	ARM B	I	ARM C	I	ARM D	I	
I	16.30 - 16.45	I		I	I	I	I	I	I	I	I	I	
I		I	ARM A	I	0.000	I	0.037	I	0.858	I	0.105	I	
I		I		I	0.0	I	6.0	I	139.0	I	17.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM B	I	0.545	I	0.000	I	0.364	I	0.091	I	
I		I		I	6.0	I	0.0	I	4.0	I	1.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM C	I	0.862	I	0.007	I	0.000	I	0.131	I	
I		I		I	125.0	I	1.0	I	0.0	I	19.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM D	I	0.675	I	0.050	I	0.275	I	0.000	I	
I		I		I	81.0	I	6.0	I	33.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I	16.45 - 17.00	I		I	I	I	I	I	I	I	I	I	
I		I	ARM A	I	0.000	I	0.037	I	0.858	I	0.105	I	
I		I		I	0.0	I	6.0	I	139.0	I	17.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.1)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM B	I	0.545	I	0.000	I	0.364	I	0.091	I	
I		I		I	6.0	I	0.0	I	4.0	I	1.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM C	I	0.862	I	0.007	I	0.000	I	0.131	I	
I		I		I	125.0	I	1.0	I	0.0	I	19.0	I	
I		I		I	(0.1)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	
I		I	ARM D	I	0.675	I	0.050	I	0.275	I	0.000	I	
I		I		I	81.0	I	6.0	I	33.0	I	0.0	I	
I		I		I	(0.0)	I	(0.0)	I	(0.0)	I	(0.0)	I	
I		I		I	I	I	I	I	I	I	I	I	

TURNING PROPORTIONS ARE CALCULATED FROM TURNING COUNT DATA

THE TURNING PROPORTIONS USED VARY BETWEEN TIME SEGMENTS

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.00-16.15								
B-ACD	0.19	8.61	0.022		0.0	0.0	0.3	
A-BCD	0.38	11.79	0.032		0.0	0.0	0.6	
A-B	0.10							
A-C	2.36							
D-ABC	2.10	9.68	0.217		0.0	0.3	3.9	
C-ABD	0.02	11.68	0.002		0.0	0.0	0.0	
C-D	0.33							
C-A	2.19							

TIME	DEMAND	CAPACITY	DEMAND/ CAPACITY	PEDESTRIAN FLOW	START QUEUE	END QUEUE	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC TIME
16.15-16.30								
B-ACD	0.20	8.55	0.023		0.0	0.0	0.4	
A-BCD	0.40	11.84	0.034		0.0	0.0	0.7	
A-B	0.11							
A-C	2.46							
D-ABC	2.20	9.64	0.228		0.3	0.3	4.3	
C-ABD	0.02	11.73	0.002		0.0	0.0	0.0	
C-D	0.35							
C-A	2.29							

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	16.30-16.45								
I									
I	B-ACD	0.18	8.73	0.021		0.0	0.0	0.3	
I									
I	A-BCD	0.33	11.69	0.029		0.0	0.0	0.6	
I									
I	A-B	0.09							
I									
I	A-C	2.14							
I									
I	D-ABC	1.90	9.76	0.195		0.3	0.2	3.7	
I									
I	C-ABD	0.02	11.59	0.002		0.0	0.0	0.0	
I									
I	C-D	0.30							
I									
I	C-A	1.98							
I									
I									
I									

I	TIME	DEMAND	CAPACITY	DEMAND/	PEDESTRIAN	START	END	DELAY	GEOMETRIC
DELAYI		(VEH/MIN)	(VEH/MIN)	CAPACITY	FLOW	QUEUE	QUEUE	(VEH.MIN/	
(VEH.MIN/	I			(RFC)	(PEDS/MIN)	(VEHS)	(VEHS)	TIME SEGMENT)	TIME
I	SEGMENT) I								
I	16.45-17.00								
I									
I	B-ACD	0.17	8.79	0.019		0.0	0.0	0.3	
I									
I	A-BCD	0.31	11.63	0.027		0.0	0.0	0.5	
I									
I	A-B	0.09							
I									
I	A-C	2.03							
I									
I	D-ABC	1.80	9.80	0.184		0.2	0.2	3.5	
I									
I	C-ABD	0.02	11.54	0.002		0.0	0.0	0.0	
I									
I	C-D	0.29							
I									
I	C-A	1.88							
I									
I									
I									

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-ACD

TIME SEGMENT	NO. OF
ENDING	VEHICLES
	IN QUEUE

16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM A-BCD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM D-ABC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.3
16.30	0.3
16.45	0.2
17.00	0.2

QUEUE FOR STREAM C-ABD

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I		
I		I		I	* DELAY *	I	* DELAY *	I		
I		I		I		I		I		
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)	I
I	B-ACD	I	11.1	I	11.1	I	1.3	I	0.12	I
I	A-BCD	I	21.3	I	21.3	I	2.4	I	0.11	I
I	A-B	I	5.8	I	5.8	I		I		I
I	A-C	I	135.0	I	135.0	I		I		I
I	D-ABC	I	120.0	I	120.0	I	15.5	I	0.13	I
I	C-ABD	I	1.3	I	1.3	I	0.1	I	0.09	I
I	C-D	I	19.0	I	19.0	I		I		I
I	C-A	I	125.0	I	125.0	I		I		I
I	ALL	I	438.5	I	438.5	I	19.3	I	0.04	I

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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***** PICADY 4 run completed.  
===== end of file  
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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY17.vpi" (drive-on-the-left) at 14:26:07 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2032 Weekday Am Pk Hr With Phase 1

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I (W)	6.50 M.	I
I	CENTRAL RESERVE WIDTH	I (WCR)	0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I (WC-B)	2.20 M.	I
I	- VISIBILITY	I (VC-B)	49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I (VB-C)	45.0 M.	I
I	- VISIBILITY TO RIGHT	I (VB-A)	45.0 M.	I
I	- LANE 1 WIDTH	I (WB-C)	3.00 M.	I
I	- LANE 2 WIDTH	I (WB-A)	0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
11.00 - 11.15		ARM A	0.000	0.130	0.870			
			0.0	10.0	67.0			
			(0.0)	(0.0)	(4.5)			
		ARM B	0.571	0.000	0.429			
			8.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.948	0.052	0.000			
			109.0	6.0	0.0			
			(11.9)	(0.0)	(0.0)			
11.15 - 11.30		ARM A	0.000	0.130	0.870			
			0.0	10.0	67.0			
			(0.0)	(0.0)	(4.5)			
		ARM B	0.571	0.000	0.429			
			8.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.948	0.052	0.000			
			109.0	6.0	0.0			
			(11.9)	(0.0)	(0.0)			


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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 11.15-11.30
I
I B-AC 0.22 8.93 0.025 0.0 0.0 0.4
I
I C-AB 0.11 10.85 0.010 0.0 0.0 0.2
I
I C-A 1.71
I
I A-B 0.16
I
I A-C 1.06
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 11.30-11.45
I
I B-AC 0.25 8.87 0.028 0.0 0.0 0.4
I
I C-AB 0.13 10.94 0.012 0.0 0.0 0.2
I
I C-A 1.89
I
I A-B 0.18
I
I A-C 1.17
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 11.45-12.00
I
I B-AC 0.26 8.85 0.029 0.0 0.0 0.4
I

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I	C-AB	0.13	10.98	0.012	0.0	0.0	0.2
I							
I	C-A	1.98					
I							
I	A-B	0.18					
I							
I	A-C	1.23					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	14.1	I	14.1	I	1.6	I	0.11
I	C-AB	I	7.2	I	7.2	I	0.7	I	0.10
I	C-A	I	108.0	I	108.0	I		I	
I	A-B	I	10.0	I	10.0	I		I	
I	A-C	I	67.1	I	67.1	I		I	
I	ALL	I	206.4	I	206.4	I	2.3	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.

===== end of file

=====

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
RELEASE 4.0 (NOV 2003)

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Run with file:- "e:\21760PY18.vpi" (drive-on-the-left) at 14:32:15 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2032 Weekday PM Pk Hr With Phase 1

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I (W)	6.50 M.	I
I	CENTRAL RESERVE WIDTH	I (WCR)	0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I (WC-B)	2.20 M.	I
I	- VISIBILITY	I (VC-B)	49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I (VB-C)	45.0 M.	I
I	- VISIBILITY TO RIGHT	I (VB-A)	45.0 M.	I
I	- LANE 1 WIDTH	I (WB-C)	3.00 M.	I
I	- LANE 2 WIDTH	I (WB-A)	0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 17.00 AND ENDS 18.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
17.00 - 17.15		ARM A	0.000	0.054	0.946			
			0.0	8.0	141.0			
			(0.0)	(0.0)	(2.8)			
		ARM B	0.625	0.000	0.375			
			10.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.960	0.040	0.000			
			144.0	6.0	0.0			
			(4.2)	(0.0)	(0.0)			
17.15 - 17.30		ARM A	0.000	0.054	0.946			
			0.0	8.0	141.0			
			(0.0)	(0.0)	(2.8)			
		ARM B	0.625	0.000	0.375			
			10.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.960	0.040	0.000			
			144.0	6.0	0.0			
			(4.2)	(0.0)	(0.0)			


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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 17.15-17.30
I
I B-AC 0.30 8.33 0.036 0.0 0.0 0.5
I
I C-AB 0.14 11.17 0.013 0.0 0.0 0.2
I
I C-A 2.61
I
I A-B 0.15
I
I A-C 2.58
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 17.30-17.45
I
I B-AC 0.26 8.47 0.031 0.0 0.0 0.5
I
I C-AB 0.12 11.01 0.011 0.0 0.0 0.2
I
I C-A 2.26
I
I A-B 0.13
I
I A-C 2.23
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 17.45-18.00
I
I B-AC 0.24 8.51 0.028 0.0 0.0 0.4
I

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I	C-AB	0.11	10.96	0.010	0.0	0.0	0.2
I							
I	C-A	2.14					
I							
I	A-B	0.12					
I							
I	A-C	2.11					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	16.2	I	16.2	I	2.0	I	0.12
I	C-AB	I	7.6	I	7.6	I	0.8	I	0.10
I	C-A	I	142.5	I	142.5	I		I	
I	A-B	I	8.0	I	8.0	I		I	
I	A-C	I	140.8	I	140.8	I		I	
I	ALL	I	315.1	I	315.1	I	2.7	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.

===== end of file

=====

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
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Run with file:- "e:\21760PY19.vpi" (drive-on-the-left) at 14:35:17 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2032 Weekend AM Pk Hr With Phase 1

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.50 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 45.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 45.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 3.00 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
11.00 - 11.15		ARM A	0.000	0.100	0.900			
			0.0	10.0	90.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.571	0.000	0.429			
			8.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.969	0.031	0.000			
			158.0	5.0	0.0			
			(0.1)	(0.0)	(0.0)			
11.15 - 11.30		ARM A	0.000	0.100	0.900			
			0.0	10.0	90.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.571	0.000	0.429			
			8.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.963	0.037	0.000			
			158.0	6.0	0.0			
			(0.1)	(0.0)	(0.0)			


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I  TIME          DEMAND  CAPACITY  DEMAND/  PEDESTRIAN  START  END          DELAY  GEOMETRIC
DELAYI          (VEH/MIN) (VEH/MIN) CAPACITY  FLOW        QUEUE  QUEUE        (VEH.MIN/
(VEH.MIN/      I          (RFC)      (PEDS/MIN) (VEHS) (VEHS)  TIME SEGMENT)  TIME
I
SEGMENT) I
I 11.15-11.30
I
I  B-AC          0.22      8.79      0.025          0.0      0.0          0.4
I
I  C-AB          0.12      11.35     0.011          0.0      0.0          0.2
I
I  C-A           2.47
I
I  A-B           0.16
I
I  A-C           1.43
I
I
I
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I  TIME          DEMAND  CAPACITY  DEMAND/  PEDESTRIAN  START  END          DELAY  GEOMETRIC
DELAYI          (VEH/MIN) (VEH/MIN) CAPACITY  FLOW        QUEUE  QUEUE        (VEH.MIN/
(VEH.MIN/      I          (RFC)      (PEDS/MIN) (VEHS) (VEHS)  TIME SEGMENT)  TIME
I
SEGMENT) I
I 11.30-11.45
I
I  B-AC          0.25      8.72      0.029          0.0      0.0          0.4
I
I  C-AB          0.14      11.50     0.012          0.0      0.0          0.2
I
I  C-A           2.73
I
I  A-B           0.17
I
I  A-C           1.58
I
I
I
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I  TIME          DEMAND  CAPACITY  DEMAND/  PEDESTRIAN  START  END          DELAY  GEOMETRIC
DELAYI          (VEH/MIN) (VEH/MIN) CAPACITY  FLOW        QUEUE  QUEUE        (VEH.MIN/
(VEH.MIN/      I          (RFC)      (PEDS/MIN) (VEHS) (VEHS)  TIME SEGMENT)  TIME
I
SEGMENT) I
I 11.45-12.00
I
I  B-AC          0.26      8.69      0.030          0.0      0.0          0.5
I

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I	C-AB	0.14	11.56	0.013	0.0	0.0	0.2
I							
I	C-A	2.86					
I							
I	A-B	0.18					
I							
I	A-C	1.66					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	14.1	I	14.1	I	1.6	I	0.11
I	C-AB	I	7.5	I	7.5	I	0.7	I	0.10
I	C-A	I	156.3	I	156.3	I		I	
I	A-B	I	10.0	I	10.0	I		I	
I	A-C	I	90.2	I	90.2	I		I	
I	ALL	I	278.1	I	278.1	I	2.3	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.

===== end of file

=====

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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Run with file:- "e:\21760PY20.vpi" (drive-on-the-left) at 14:38:47 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2032 Weekend PM Pk Hr With Phase 1

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I (W)	6.50 M.	I
I	CENTRAL RESERVE WIDTH	I (WCR)	0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I (WC-B)	2.20 M.	I
I	- VISIBILITY	I (VC-B)	49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I (VB-C)	45.0 M.	I
I	- VISIBILITY TO RIGHT	I (VB-A)	45.0 M.	I
I	- LANE 1 WIDTH	I (WB-C)	3.00 M.	I
I	- LANE 2 WIDTH	I (WB-A)	0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.00 AND ENDS 17.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
16.00 - 16.15		ARM A	0.000	0.049	0.951			
			0.0	8.0	154.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.625	0.000	0.375			
			10.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.971	0.029	0.000			
			203.0	6.0	0.0			
			(0.1)	(0.0)	(0.0)			
16.15 - 16.30		ARM A	0.000	0.049	0.951			
			0.0	8.0	154.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.625	0.000	0.375			
			10.0	0.0	6.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.971	0.029	0.000			
			203.0	6.0	0.0			
			(0.1)	(0.0)	(0.0)			


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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 16.15-16.30
I
I B-AC 0.30 8.18 0.037 0.0 0.0 0.6
I
I C-AB 0.16 11.88 0.013 0.0 0.0 0.2
I
I C-A 3.67
I
I A-B 0.15
I
I A-C 2.82
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 16.30-16.45
I
I B-AC 0.26 8.34 0.031 0.0 0.0 0.5
I
I C-AB 0.13 11.63 0.011 0.0 0.0 0.2
I
I C-A 3.18
I
I A-B 0.13
I
I A-C 2.44
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 16.45-17.00
I
I B-AC 0.24 8.39 0.029 0.0 0.0 0.5
I

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I	C-AB	0.12	11.54	0.010	0.0	0.0	0.2
I							
I	C-A	3.01					
I							
I	A-B	0.12					
I							
I	A-C	2.31					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	16.2	I	16.2	I	2.0	I	0.12
I	C-AB	I	8.3	I	8.3	I	0.8	I	0.10
I	C-A	I	200.6	I	200.6	I		I	
I	A-B	I	8.0	I	8.0	I		I	
I	A-C	I	154.1	I	154.1	I		I	
I	ALL	I	387.3	I	387.3	I	2.8	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.

===== end of file

=====

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
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Run with file:- "e:\21760PY21.vpi" (drive-on-the-left) at 14:45:05 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2046 Weekday Am Pk Hr With Phase 2

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I (W)	6.50 M.	I
I	CENTRAL RESERVE WIDTH	I (WCR)	0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I (WC-B)	2.20 M.	I
I	- VISIBILITY	I (VC-B)	49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I (VB-C)	45.0 M.	I
I	- VISIBILITY TO RIGHT	I (VB-A)	45.0 M.	I
I	- LANE 1 WIDTH	I (WB-C)	3.00 M.	I
I	- LANE 2 WIDTH	I (WB-A)	0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
11.00 - 11.15		ARM A	0.000	0.142	0.858			
			0.0	15.0	91.0			
			(0.0)	(0.0)	(6.6)			
		ARM B	0.588	0.000	0.412			
			10.0	0.0	7.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.920	0.080	0.000			
			103.0	9.0	0.0			
			(15.5)	(0.0)	(0.0)			
11.15 - 11.30		ARM A	0.000	0.142	0.858			
			0.0	15.0	91.0			
			(0.0)	(0.0)	(6.6)			
		ARM B	0.588	0.000	0.412			
			10.0	0.0	7.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.920	0.080	0.000			
			103.0	9.0	0.0			
			(15.5)	(0.0)	(0.0)			


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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 11.15-11.30
I
I B-AC 0.27 8.77 0.031 0.0 0.0 0.5
I
I C-AB 0.17 10.66 0.016 0.0 0.0 0.3
I
I C-A 1.61
I
I A-B 0.24
I
I A-C 1.44
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 11.30-11.45
I
I B-AC 0.30 8.70 0.034 0.0 0.0 0.5
I
I C-AB 0.19 10.73 0.018 0.0 0.0 0.3
I
I C-A 1.77
I
I A-B 0.26
I
I A-C 1.60
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 11.45-12.00
I
I B-AC 0.31 8.67 0.036 0.0 0.0 0.5
I

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I	C-AB	0.20	10.77	0.019	0.0	0.0	0.3
I							
I	C-A	1.86					
I							
I	A-B	0.28					
I							
I	A-C	1.67					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	17.1	I	17.1	I	2.0	I	0.12
I	C-AB	I	10.7	I	10.7	I	1.2	I	0.11
I	C-A	I	101.5	I	101.5	I		I	
I	A-B	I	15.0	I	15.0	I		I	
I	A-C	I	91.2	I	91.2	I		I	
I	ALL	I	235.5	I	235.5	I	3.1	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.

===== end of file

=====

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

PICADY 4.1 ANALYSIS PROGRAM
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Run with file:- "e:\21760PY22.vpi" (drive-on-the-left) at 14:50:31 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2046 Weekday PM Pk Hr With Phase 2

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I (W)	6.50 M.	I
I	CENTRAL RESERVE WIDTH	I (WCR)	0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I (WC-B)	2.20 M.	I
I	- VISIBILITY	I (VC-B)	49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I (VB-C)	45.0 M.	I
I	- VISIBILITY TO RIGHT	I (VB-A)	45.0 M.	I
I	- LANE 1 WIDTH	I (WB-C)	3.00 M.	I
I	- LANE 2 WIDTH	I (WB-A)	0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 17.00 AND ENDS 18.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
17.00 - 17.15		ARM A	0.000	0.047	0.953			
			0.0	10.0	204.0			
			(0.0)	(0.0)	(4.4)			
		ARM B	0.625	0.000	0.375			
			15.0	0.0	9.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.939	0.061	0.000			
			108.0	7.0	0.0			
			(3.7)	(0.0)	(0.0)			
17.15 - 17.30		ARM A	0.000	0.047	0.953			
			0.0	10.0	204.0			
			(0.0)	(0.0)	(4.4)			
		ARM B	0.625	0.000	0.375			
			15.0	0.0	9.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.939	0.061	0.000			
			108.0	7.0	0.0			
			(3.7)	(0.0)	(0.0)			


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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 17.15-17.30
I
I B-AC 0.44 8.10 0.054 0.1 0.1 0.8
I
I C-AB 0.16 10.46 0.015 0.0 0.0 0.3
I
I C-A 1.95
I
I A-B 0.18
I
I A-C 3.75
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 17.30-17.45
I
I B-AC 0.38 8.27 0.046 0.1 0.0 0.7
I
I C-AB 0.13 10.39 0.013 0.0 0.0 0.2
I
I C-A 1.69
I
I A-B 0.16
I
I A-C 3.23
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 17.45-18.00
I
I B-AC 0.36 8.32 0.043 0.0 0.0 0.7
I

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I	C-AB	0.12	10.38	0.012	0.0	0.0	0.2
I							
I	C-A	1.61					
I							
I	A-B	0.15					
I							
I	A-C	3.06					
I							
I							

 WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.1
17.30	0.1
17.45	0.0
18.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
17.15	0.0
17.30	0.0
17.45	0.0
18.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	24.0	I	24.0	I	3.1	I	0.13
I	C-AB	I	8.5	I	8.5	I	0.9	I	0.11
I	C-A	I	106.6	I	106.6	I		I	
I	A-B	I	10.0	I	10.0	I		I	
I	A-C	I	204.2	I	204.2	I		I	
I	ALL	I	353.2	I	353.2	I	4.0	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .
 * INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE
 END OF THE TIME PERIOD.
 * THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE
 END OF THE TIME PERIOD.

END OF JOB

***** PICADY 4 run completed.

===== end of file
 =====

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CAPACITIES, QUEUES, AND DELAYS AT 3 OR 4-ARM MAJOR/MINOR PRIORITY JUNCTIONS

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Run with file:- "e:\21760PY23.vpi" (drive-on-the-left) at 14:56:07 on Wednesday, 11
September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2046 Weekend AM Pk Hr With Phase 2

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I	(W) 6.50 M.	I
I	CENTRAL RESERVE WIDTH	I	(WCR) 0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I	(WC-B) 2.20 M.	I
I	- VISIBILITY	I	(VC-B) 49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I	(VB-C) 45.0 M.	I
I	- VISIBILITY TO RIGHT	I	(VB-A) 45.0 M.	I
I	- LANE 1 WIDTH	I	(WB-C) 3.00 M.	I
I	- LANE 2 WIDTH	I	(WB-A) 0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 11.00 AND ENDS 12.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
11.00 - 11.15		ARM A	0.000	0.107	0.893			
			0.0	15.0	125.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.588	0.000	0.412			
			10.0	0.0	7.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.935	0.065	0.000			
			130.0	9.0	0.0			
			(0.1)	(0.0)	(0.0)			
11.15 - 11.30		ARM A	0.000	0.107	0.893			
			0.0	15.0	125.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.588	0.000	0.412			
			10.0	0.0	7.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.935	0.065	0.000			
			130.0	9.0	0.0			
			(0.1)	(0.0)	(0.0)			


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I  TIME          DEMAND  CAPACITY  DEMAND/  PEDESTRIAN  START  END          DELAY  GEOMETRIC
DELAYI          (VEH/MIN) (VEH/MIN) CAPACITY  FLOW        QUEUE  QUEUE        (VEH.MIN/
(VEH.MIN/      I          (RFC)      (PEDS/MIN) (VEHS) (VEHS)  TIME SEGMENT)  TIME
I
SEGMENT) I
I 11.15-11.30
I
I  B-AC          0.27      8.64      0.031          0.0      0.0          0.5
I
I  C-AB          0.17      10.93     0.016          0.0      0.0          0.3
I
I  C-A           2.03
I
I  A-B           0.24
I
I  A-C           1.97
I
I
I
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I  TIME          DEMAND  CAPACITY  DEMAND/  PEDESTRIAN  START  END          DELAY  GEOMETRIC
DELAYI          (VEH/MIN) (VEH/MIN) CAPACITY  FLOW        QUEUE  QUEUE        (VEH.MIN/
(VEH.MIN/      I          (RFC)      (PEDS/MIN) (VEHS) (VEHS)  TIME SEGMENT)  TIME
I
SEGMENT) I
I 11.30-11.45
I
I  B-AC          0.30      8.56      0.035          0.0      0.0          0.5
I
I  C-AB          0.20      11.03     0.018          0.0      0.0          0.3
I
I  C-A           2.24
I
I  A-B           0.26
I
I  A-C           2.19
I
I
I
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I  TIME          DEMAND  CAPACITY  DEMAND/  PEDESTRIAN  START  END          DELAY  GEOMETRIC
DELAYI          (VEH/MIN) (VEH/MIN) CAPACITY  FLOW        QUEUE  QUEUE        (VEH.MIN/
(VEH.MIN/      I          (RFC)      (PEDS/MIN) (VEHS) (VEHS)  TIME SEGMENT)  TIME
I
SEGMENT) I
I 11.45-12.00
I
I  B-AC          0.31      8.52      0.036          0.0      0.0          0.6
I

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I	C-AB	0.21	11.08	0.019	0.0	0.0	0.3
I							
I	C-A	2.34					
I							
I	A-B	0.27					
I							
I	A-C	2.29					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
11.15	0.0
11.30	0.0
11.45	0.0
12.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	17.1	I	17.1	I	2.0	I	0.12
I	C-AB	I	11.2	I	11.2	I	1.2	I	0.11
I	C-A	I	128.0	I	128.0	I		I	
I	A-B	I	15.0	I	15.0	I		I	
I	A-C	I	124.8	I	124.8	I		I	
I	ALL	I	296.1	I	296.1	I	3.2	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

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END OF JOB

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September 2024

RUN TITLE

R352 Main Street/Village Car Park Acc Jct - 2046 Weekend PM Pk Hr With Phase 2

.MAJOR/MINOR JUNCTION CAPACITY AND DELAY

INPUT DATA

MAJOR ROAD (ARM C) ----- MAJOR ROAD (ARM A)
I
I
I
I
I
I
MINOR ROAD (ARM B)

ARM A IS R352 Main Street West
ARM B IS Village Car Park Access
ARM C IS R352 Main Street East

STREAM LABELLING CONVENTION

STREAM A-B CONTAINS TRAFFIC GOING FROM ARM A TO ARM B

STREAM B-AC CONTAINS TRAFFIC GOING FROM ARM B TO ARM A AND TO ARM C

ETC.

.GEOMETRIC DATA

I	DATA ITEM	I	MINOR ROAD B	I
I	TOTAL MAJOR ROAD CARRIAGEWAY WIDTH	I (W)	6.50 M.	I
I	CENTRAL RESERVE WIDTH	I (WCR)	0.00 M.	I
I		I		I
I	MAJOR ROAD RIGHT TURN - WIDTH	I (WC-B)	2.20 M.	I
I	- VISIBILITY	I (VC-B)	49.0 M.	I
I	- BLOCKS TRAFFIC	I	YES	I
I		I		I
I	MINOR ROAD - VISIBILITY TO LEFT	I (VB-C)	45.0 M.	I
I	- VISIBILITY TO RIGHT	I (VB-A)	45.0 M.	I
I	- LANE 1 WIDTH	I (WB-C)	3.00 M.	I
I	- LANE 2 WIDTH	I (WB-A)	0.00 M.	I

.TRAFFIC DEMAND DATA

TIME PERIOD BEGINS 16.00 AND ENDS 17.00

LENGTH OF TIME PERIOD - 60 MINUTES.

LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE INPUT DIRECTLY.

		TURNING PROPORTIONS						
		TURNING COUNTS						
		(PERCENTAGE OF H.V.S)						
TIME		FROM/TO	ARM A	ARM B	ARM C			
16.00 - 16.15		ARM A	0.000	0.042	0.958			
			0.0	10.0	226.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.625	0.000	0.375			
			15.0	0.0	9.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.954	0.046	0.000			
			145.0	7.0	0.0			
			(0.1)	(0.0)	(0.0)			
16.15 - 16.30		ARM A	0.000	0.042	0.958			
			0.0	10.0	226.0			
			(0.0)	(0.0)	(0.1)			
		ARM B	0.625	0.000	0.375			
			15.0	0.0	9.0			
			(0.0)	(0.0)	(0.0)			
		ARM C	0.954	0.046	0.000			
			145.0	7.0	0.0			
			(0.1)	(0.0)	(0.0)			


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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 16.15-16.30
I
I B-AC 0.44 7.98 0.055 0.1 0.1 0.9
I
I C-AB 0.17 10.89 0.015 0.0 0.0 0.3
I
I C-A 2.61
I
I A-B 0.18
I
I A-C 4.14
I
I
I
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 16.30-16.45
I
I B-AC 0.38 8.16 0.047 0.1 0.0 0.8
I
I C-AB 0.14 10.77 0.013 0.0 0.0 0.2
I
I C-A 2.27
I
I A-B 0.16
I
I A-C 3.57
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I TIME DEMAND CAPACITY DEMAND/ PEDESTRIAN START END DELAY GEOMETRIC
DELAYI (VEH/MIN) (VEH/MIN) CAPACITY FLOW QUEUE QUEUE (VEH.MIN/
(VEH.MIN/ I (RFC) (PEDS/MIN) (VEHS) (VEHS) TIME SEGMENT) TIME
I SEGMENT) I
I 16.45-17.00
I
I B-AC 0.36 8.16 0.044 0.0 0.0 0.7
I

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I	C-AB	0.17	11.05	0.015	0.0	0.0	0.3
I							
I	C-A	2.61					
I							
I	A-B	0.15					
I							
I	A-C	3.39					
I							
I							

WARNING NO MARGINAL ANALYSIS OF CAPACITIES AS MAJOR ROAD BLOCKING MAY OCCUR

QUEUE FOR STREAM B-AC

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.1
16.30	0.1
16.45	0.0
17.00	0.0

QUEUE FOR STREAM C-AB

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
16.15	0.0
16.30	0.0
16.45	0.0
17.00	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

I	STREAM	I	TOTAL DEMAND	I	* QUEUEING *	I	* INCLUSIVE QUEUEING *	I	
I		I		I	* DELAY *	I	* DELAY *	I	
I		I		I		I		I	
I	I	(VEH)	(VEH/H)	I	(MIN)	(MIN/VEH)	I	(MIN)	(MIN/VEH)
I	B-AC	I	24.0	I	24.0	I	3.1	I	0.13
I	C-AB	I	9.5	I	9.5	I	1.0	I	0.10
I	C-A	I	149.9	I	149.9	I		I	
I	A-B	I	10.0	I	10.0	I		I	
I	A-C	I	225.8	I	225.8	I		I	
I	ALL	I	419.3	I	419.3	I	4.1	I	0.01

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD .

* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.

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END OF JOB

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APPENDIX 10.1

BIRD SURVEY REPORT (2021 - 2024)

PROPOSED DEVELOPMENT ON INIS CEALTRA AND AT MOUNTSHANNON, COUNTY CLARE.



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024



Bird Survey Report (2021 – 2024)
Proposed Development on Inis Cealtra and at
Mountshannon, County Clare.

Clare County Council

November 2024

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Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
21760	6024	A	November 2024	OV/DOB	FMK		DRAFT

MWP, Engineering and Environmental Consultants
Address: Reen Point, Blennerville, Tralee, Co. Kerry, V92 X2TK
www.mwp.ie



1. Introduction

Malachy Walsh and Partners (MWP), Engineering and Environmental Consultants were appointed by the Applicant to undertake bird surveys at Inis Cealtra Island and on the mainland to inform an impact assessment of a proposed development (the 'Inis Cealtra Visitor Experience').

This report presents the findings of bird surveys conducted by MWP during the period of March 2021 to January 2024 for the publicly owned island of Inis Cealtra, in Lough Derg, and Mountshannon village, Co. Clare. The report has been informed by both desktop and field studies in order to identify potential avian sensitivities to the proposed development.

Lough Derg is designated as a Special Protection Area (SPA) for supporting resident populations of cormorant (*Phalacrocorax carbo*) and tufted duck (*Aythya fuligula*), breeding populations of common tern (*Sterna hirundo*) and wintering populations of goldeneye (*Bucephala clangula*). These four species along with the habitat and species complex 'wetland and waterbirds' comprise the Special Conservation Interests (SCIs) for which Lough Derg is designated as an SPA.

1.1 Statement of Authority

The bird surveys were scoped and designed by John N. Murphy (consultant Senior Ornithologist, formerly with MWP), while survey data was managed and co-ordinated by Ciara Barry-Hannon (BSc) (former Ecologist with MWP) and Orla van der Noll (MSc, BSc) (Ecologist with MWP).

The field surveyors for the site were; John N. Murphy, Ciara Barry-Hannon, Noreen Lynch (BSc), Paidi Cullinan and Orla van der Noll. This report was prepared by Orla van der Noll and Deirdre O' Brien (BSc).

1.2 Site Description

The proposed development site is partly located on the shore of Lough Derg at Mountshannon village, Co. Clare. Further elements of the proposed project are being proposed for Inis Cealtra, an uninhabited island, located in Lough Derg, approximately 1.7 km south-west of Mountshannon village and approximately 300 m south-east of Knockaphort pier.

Inis Cealtra island is c.46 acres and is renowned for its ecclesiastical heritage. The last remaining area of this built heritage is located towards the east of the island. The location of Inis Cealtra in the wider landscape of Lough Derg is shown in **Figure 1**, below. Lands contained within the curtilage of the extant ecclesiastical built heritage on the island are managed by the Office of Public Works (OPW) as a National Monument. The area around the ecclesiastical monuments is maintained with the curtilage being fenced and walled to protect these monuments from livestock. The bedrock geology of the island is '*Dinantian lower impure limestone*' while the subsoils consist of limestone till. See **Appendix 1** for a habitat map of Inis Cealtra.



Figure 1. Proposed development site location

1.3 Scientific Nomenclature: Conventions

Species nomenclature follows the standard form of the common name, followed by the binomial, on the first instance of usage in the text. Thereafter, for any subsequent usage, common names only are used. Additionally, the taxonomy and nomenclature followed in this report follows that of the List of Birds of the European Union (EU Commission, 2018), as per reporting requirements under Article 12 of the Birds Directive for the period 2013-2018.

2. Desktop Study

The project site is located within the Lower Shannon hydrological catchment area. This catchment area encompasses the full extent of Lough Derg and the land that drains to it. Lough Derg is of importance for both breeding and wintering birds.

During the breeding season, islands on Lough Derg support a nationally important breeding colony of common tern while large numbers of black-headed gull (*Larus ridibundus*) have traditionally bred on the many islands. The islands in the lake also support a nationally important cormorant colony. Lough Derg is also a noted breeding site for great crested grebe (*Podiceps cristatus*) and tufted duck¹.

In winter, the lake is important for a range of waterfowl species, including nationally important populations of tufted duck and goldeneye. Other species which occur in winter include mute swan (*Cygnus olor*), whooper swan (*Cygnus cygnus*), wigeon (*Anas penelope*), teal (*Anas crecca*), mallard (*Anas platyrhynchos*), little grebe (*Tachybaptus ruficollis*), cormorant, coot (*Fulica atra*), lapwing (*Vanellus vanellus*), curlew (*Numenius arquata*) and black-headed gull.

Areas to north and southwest of Lough Derg have been utilised in the past by small numbers of Greenland white-fronted goose (*Anser albifrons flavirostris*). Hen harrier (*Circus cyaneus*) is also known to roost in the reedbeds on the margins of the site during the winter (NPWS, 2014).

2.1 Desktop Study

A desktop study was carried out prior to the commencement of bird survey-work. This provided the opportunity to gain an understanding of bird populations using the area through an investigation of the habitats present and previous species records. Available ornithological data was reviewed which includes the following :

- Review of on-line sources: National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC)
- Review of Bird Atlases: (Sharrock, 1976; Lack, 1986; Gibbons et al., 1993; Balmer et al., 2013)
- Review of Birds of Conservation Concern in Ireland (BoCCI) 2020-2026 (Gilbert et al., 2021)
- Review of BirdWatch Ireland I-WeBS (Irish Wetland Bird Surveys) site information and
- General ornithological information (www.birdwatchireland.ie).

¹ <https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004058.pdf>

2.2 Natura 2000 Designated Sites

2.3 Criteria for Identifying Target Species

The results of the desktop study were used to identify those bird species which were considered likely to occur within the general area. Of these, target species were identified which formed the focus of the bird surveys.

Initially, the Scottish Natural Heritage (SNH) 2017 guidance document '*Recommended bird survey methods to inform impact assessment of onshore wind farms*' was reviewed with regard to survey scope. SNH (2017) states that target species for surveys typically comprise those species which are afforded a higher level of legislative protection and should be restricted to those likely to be affected by a development. In relation to selecting target species and scoping initial bird surveys at the proposed development site, the SNH (2017) guidance document was used to inform the target species selection process. SNH (2016) guidance on assessing potential connectivity with SPAs was also taken into consideration.

In relation to the proposed development site, the target species list was drawn from:

- Annex I of the Birds Directive (2009/147/EC)
- SCI of SPA within the Zone of Influence (ZoI) of the proposed development site (with a focus on Lough Derg SPA)
- Fourth Schedule species protected under the Wildlife Acts 1976-2012 (buzzards, eagles, falcons, harriers, hawks, kites, osprey, owls²) and
- Red-listed Species of Conservation Concern in Ireland (BoCCI) 2020-2026 (Gilbert et al., 2021).

2.3.1 Special Protection Areas

The European Union Directive on the Conservation of Wild Birds, known as the Birds Directive (Directive 2009/147/EC) requires Member States to designate legally protected areas for the conservation of endangered or migratory species of bird, as listed on Annex I of the Directive. These areas are known as SPAs and, since 1994, all SPAs form part of the Natura 2000 network of protected sites. The EU Birds Directive is implemented in Irish law under the European Communities (Birds and Natural Habitats) Regulations 2011.

In order to identify SPAs potentially relevant to the proposal site, the SNH (2016) guidance document '*Assessing Connectivity with SPAs*' was reviewed. This guidance provides core foraging ranges from nest-sites and roost-sites for both the breeding and winter seasons for certain bird species. SNH (2016) recommends that these core foraging ranges should be used when determining whether there is potential connectivity between development proposals and SPAs. Core foraging ranges for species specified in the guidance can range from <5 km up to 15-20 km in the case of certain species, such as barnacle goose and greylag goose (SNH, 2016).

The review of species core foraging ranges was undertaken in conjunction with a desktop exercise to identify the dominant habitats occurring within the proposal site and the wider surrounding area, as well as any particular habitat features or resources (e.g. wetlands) considered to have potential to support target species. The proposal site comprises reedbeds, sedge swamps, marsh and wet grassland and the waterbody between the mainland and the island, which forms part of the Lough Derg (Shannon) SPA, as well as the mainly built/modified environment at the proposed mainland development location.

² <http://www.irishstatutebook.ie/eli/1976/act/39/schedule/4/enacted/en/html>

On a precautionary basis, an on-line search for SPAs located within a 20 km radius of the proposal site was conducted to determine the presence of potentially relevant designated sites and identify any potential connectivity through which impacts could arise as a result of the development. The on-line search identified two SPAs of potential relevance to the development site, as outlined in **Table 1** below and **Figure 1** above.

Table 1. Special Protection Areas (SPAs) of potential relevance to the development site

Designated Site	Distance from the proposed development site	Qualifying Interests/ SCI
Lough Derg Shannon SPA	The footprint of the works is within the boundary of the SPA	<ul style="list-style-type: none"> • Cormorant (<i>Phalacrocorax carbo</i>) [A017] • Tufted duck (<i>Aythya fuligula</i>) [A061] • Goldeneye (<i>Bucephala clangula</i>) [A067] • Common tern (<i>Sterna hirundo</i>) [A193] • Wetland and Waterbirds [A999]
Slieve Aughty Mountains SPA	1.6 km west/northwest of the proposed development site	<ul style="list-style-type: none"> • Hen harrier (<i>Circus cyaneus</i>) [A082] • Merlin (<i>Falco columbarius</i>) [A098]

2.4 Ramsar Sites/Important Bird and Biodiversity Areas (IBAs)

The Convention on Wetlands, also known as the Ramsar Convention, is an intergovernmental treaty which aims to conserve and protect wetlands and their resources around the world³. It was ratified by Ireland in 1984 and came into force on 15th March 1985. While this convention is not legislation, it is an international treaty. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares. The desk-top review concluded that there are no Ramsar sites within the ZOI of the site boundary.

The Important Bird and Biodiversity Areas (IBAs) Programme, overseen by Birdlife International, aims to identify, conserve and protect those areas throughout the world considered to be of the greatest significance to bird populations⁴. The desktop review concluded that there are two IBA sites within 20 km of the site boundary (see **Table 2** below).

Table 2: IBA of potential relevance to the development site

Site Name & Code	Distance from IBA to proposed Wind Farm site	IBA Trigger Species
Lough Derg (River Shannon) ⁵	The footprint of the works is within the boundary of the SPA	Mute swan (<i>Cygnus olor</i>)
Slieve Aughty Mountains ⁶	approximately 1.6 km west/north west of the proposed development site	Hen harrier (<i>Circus cyaneus</i>)

³ <http://www.ramsar.org/>

⁴ <http://www.birdlife.org/worldwide/programmes/important-bird-and-biodiversity-areas-ibas>

⁵ <http://datazone.birdlife.org/site/factsheet/621>

⁶ <http://datazone.birdlife.org/site/factsheet/27156>

2.5 I-WeBS Sites

I-WeBS (Irish Wetland Bird Survey) is a joint project between BirdWatch Ireland and National Parks and Wildlife (NPWS) in which specific wetland sites are surveyed (BirdWatch Ireland, 2019). In order to count the wetland birds, a 'look-see' method (Bibby et al., 2000) is used in which all birds present within a pre-defined area are counted. The aim of these surveys is to monitor non-breeding birds in Ireland and contribute to population counts. The information is also important to help assess the quality of these wetland areas (BirdWatch Ireland, 2019). The bird groups to be counted for I-WeBS consist of swans and geese, ducks, divers, waders and gulls. Counts are made once per month from September to March annually (BirdWatch Ireland, 2019).

The I-WeBS site, Lough Derg (Shannon) (0J008), lies within the potential ZOI of the proposed development. A review of the site count data available on the BirdWatch Ireland website for this site (which covers the count period up until 2020/21) determined that a wide range of species are known to utilise Lough Derg.

Within this large site, there are several smaller I-WeBS sub-sites encompassed within the area of the lake in the vicinity of the proposed development site. I-WeBS data was requested for the nearby sub-sites within Lough Derg. BirdWatch Ireland indicated that recent aerial I-WeBS surveys of the requested sub-sites have not been carried out. I-WeBS ground-counted data from the wider Lough Derg area were however received and reviewed. This listed a wide range of wader and water birds recorded within Lough Derg.

2.6 Bird Atlas Records and Distribution

Bird Atlas 2007-11: 'The breeding and wintering birds of Britain and Ireland' (Balmer et al., 2013) is the most recent comprehensive work on wintering and breeding birds in Ireland. Previous Bird Atlases have been the primary source of information on the distribution and abundance of British and Irish birds prior to Bird Atlas 2007-11. The three previously published atlases were:

- Sharrock, J.T.R. (1976) The atlas of breeding birds in Britain and Ireland
- Lack, P.C. (1986) The atlas of wintering birds in Britain and Ireland and
- Gibbons, D.W., Reid, J.B. & Chapman, R.A. (1993) The new atlas of breeding birds in Britain and Ireland: 1988-1991.

The proposed development site lies within the hectads of R68 and R78. **Appendix 2** presents Wintering and Breeding Bird Atlas data (2007 – 2011) of target species recorded within these hectads.

2.7 NPWS Rare and Protected Species Dataset

An information request was sent to the NPWS requesting records from the Rare and Protected Species Database for the hectads R68 and R78. Records received from NPWS on 10th March 2021 showed no relevant records regarding any protected bird species for these two hectads. However, it was noted that "the absence of information in the NPWS dataset for an area, does not necessarily imply a low biodiversity value for that area", and that "the NPWS species dataset is incomplete, particularly for birds".

3. Methodology

3.1 Field Survey Methodology

Prior to the commencement of the field surveys, initial walkovers of the site were carried out to enable the identification of suitable survey locations. Once these locations were established, the field surveys comprised of targeted distribution and abundance surveys to gain an understanding of the bird species occurring in the area which may be subject to impacts from the proposed development.

The targeted distribution and abundance surveys comprised the following elements:

- Transect surveys, and
- Shorebird count surveys.

3.1.1 Transect Survey

A transect survey is a survey along a defined route within a survey area. In total, 26 transect surveys were carried out on the island of Inis Cealtra between March 2021 and March 2024. The overall aim of the transect surveys was to assess general bird distribution throughout the site and gather data on bird usage of the site.

All bird species seen or heard, typically within 100 m of the transect route, were recorded. The transect route was selected to provide representative coverage of all habitats, both open and closed, occurring on the island. The habitats occurring comprise mainly of stone walls and other stonework (BL1), buildings and artificial surfaces (BL3), improved agricultural grassland (GA1), dry meadows and grassy verges (GS2), amenity grassland (GA2), marsh (GM1), wet grassland (GS4), oak-ash-hazel woodland (WN2), and scrub (WS1)⁷.

⁷ Habitats classified according to Fossitt (2000)

The transect route followed the fringe of the island (See **Figure 2** below).



Figure 2: Transect route around the island of Inis Cealtra.

3.1.2 Shorebird Count Surveys

Shorebird counts were carried out in accordance with Birdwatch Ireland I-WeBS survey guidelines on both the mainland and on Inis Cealtra⁸.

Counts on the mainland were carried out at four locations: Mountshannon harbour and two fields (Field 1 and Field 2) in separate locations near Lough Derg. The shorebird counts at Mountshannon incorporated the environs of the harbour and surrounding lake and lake shore. Surveys at Field 1 and Field 2 targeted the lake and lake shore, and areas of farmland adjoining the lake comprising potentially suitable habitat for wintering waders and wildfowl, such as whooper swan. A shorebird count was also undertaken from Knockaphort pier. This count location specifically targeted Inis Cealtra and the surrounding lake area. Locations of the four waterbird count sites on the Co. Clare mainland with map of walkover transect route on Inis Cealtra are shown in **Error! Reference source not found.** below.

Counts were carried out on 14 separate occasions between October 2022 and March 2024 inclusive. The habitats encompassed by shorebird surveys included reedbeds, marsh and wet grassland, farmland and the waterbody between the mainland and the island, which forms part of the Lough Derg (Shannon) SPA. Target species for this survey included all species of wader and other waterbirds.

⁸ <https://birdwatchireland.ie/publications/i-webs-counter-manual/>

3.1.3 Informal surveys

Prior to regular mainland surveys being carried out, several informal counts were carried out at suitable locations on the shore of Lough Derg and on lands within 2 km of Inis Cealtra. These were carried out during the months of winter 2021/22.

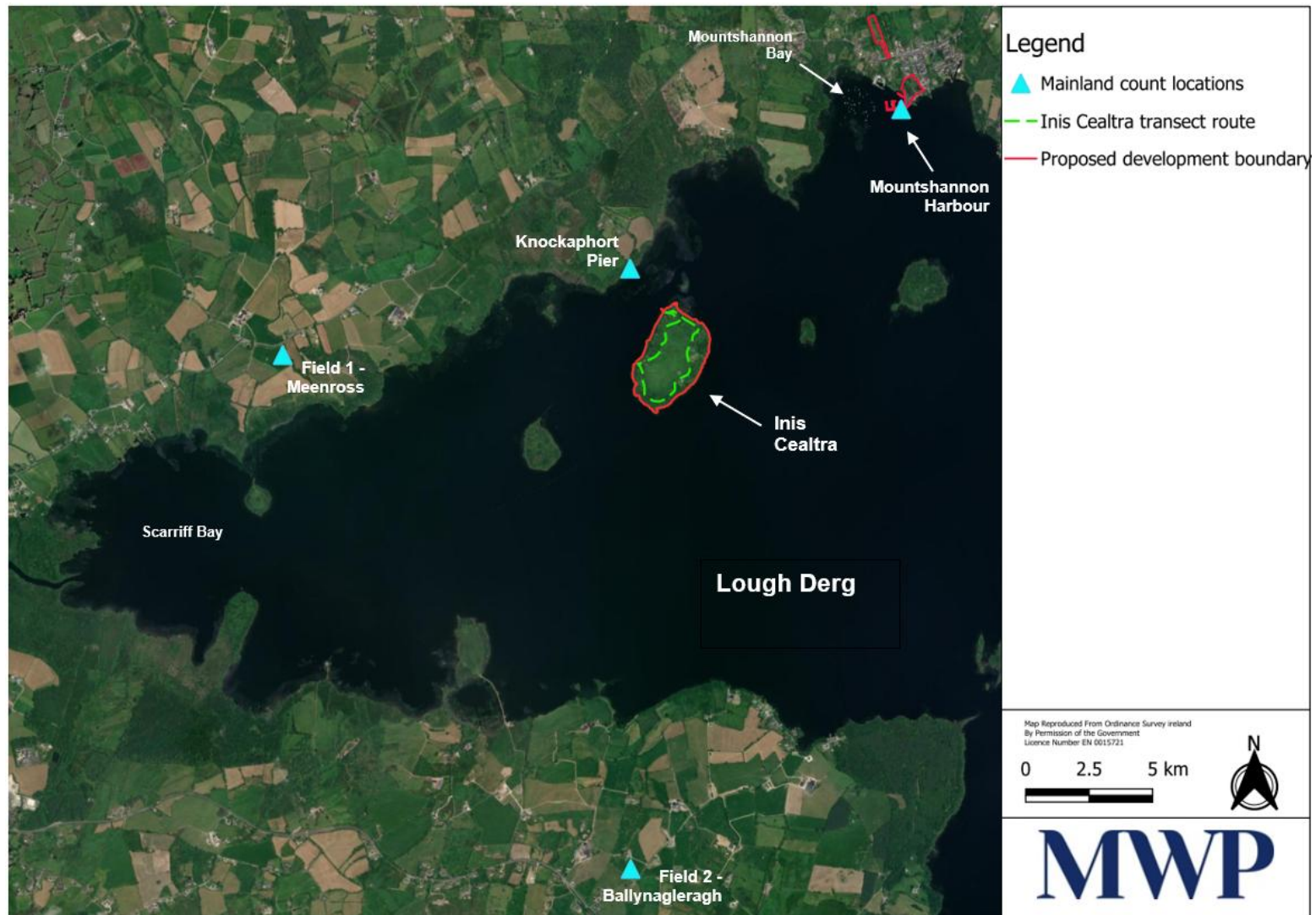


Figure 3: Locations of the four waterbird count sites on the County Clare mainland with map of walkover transect route on Inis Cealtra.

3.2 Summary of Survey Effort

Table 3 below summarises completion of bird surveys by month between March 2021 and March 2024. More information on individual surveys is summarised in **Appendix 7**.

Each month marked below comprises completion of a transect on Inis Cealtra Island and ✓✓ signifies the months transects on Inis Cealtra and shorebird counts on the mainland were carried out.

Table 3: Summary of when the bird surveys were carried out within the overall survey period

Year	Summer (Breeding)							Winter (Non-breeding)				
	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
2021	-	✓	✓	-	-	-	-	✓	✓	-	-	✓
2022	-	✓	✓	✓	✓	✓	✓✓	✓✓	✓✓	✓	-	✓
2023	-	✓✓	✓✓	✓✓	✓✓	✓✓	-	-	-	✓✓	✓✓	✓✓
2024	-	-	-	-	-	-	-	-	-	✓✓	✓✓	✓✓

4. Identification of Target Species

See **Appendix 3** for the table that outlines those species for which past records exist and which meet one or more of the target species selection criteria as outlined in **Section 2.3** above. The conservation status/level of protection afforded to each species is also included.

As outlined above, target species typically comprise those species which are afforded a higher level of legislative protection and should be restricted to those likely to be affected by the proposed development. Therefore, only red-listed species have been included as target species, unless the species meets one of the other target species selection criteria as outlined above e.g. Annex I. However, to ensure other species which may potentially be sensitive to the proposed development were not missed during surveys, all other species were included as secondary species.

5. Field Survey Results

A total of 83 bird species were recorded onsite during the overall bird survey period 43 of which were target species.

5.1 Target Species

The following 43 target species were recorded within the study area during ornithological surveys. Annex I species are highlighted in bold. In the following sub-sections, observations of target species are summarised as per surveys undertaken. Details on each survey carried out including survey date, and weather conditions can be found in **Appendix 7**. Details on Secondary species recorded can be found in **Appendix 6**.

Mainland:

- Kestrel (*Falco tinnunculus*)
- Lapwing
- Pochard (*Aythya ferina*)
- Shoveler (*Anas clypeata*)

Inis Cealtra

- **Arctic tern (*Sterna paradisaea*)** – Scariff Bay and Inis
- Curlew
- **Golden plover (*Pluvialis apricaria*)**
- Grey wagtail (*Motacilla cinerea*)
- **Hen harrier**
- Jack snipe (*Lymnocyptes minimus*)
- Meadow pipit (*Anthus pratensis*)
- Pintail (*Anas acuta*)
- Red-breasted merganser (*Mergus serrator*)
- Redshank (*Tringa totanus*)
- Redwing (*Turdus iliacus*)
- Snipe (*Gallinago gallinago*)
- Sparrowhawk (*Accipiter nisus*)
- Swift (*Apus apus*)
- Whimbrel (*Numenius phaeopus*)

Mainland and Inis Cealtra

- Black-headed gull
- Buzzard (*Buteo buteo*)
- Common gull (*Larus canus*)
- **Common tern**
- Coot
- Cormorant
- Goldeneye
- Great black-backed gull (*Larus marinus*)
- Great crested grebe
- Grey heron (*Ardea cinerea*)
- Greylag goose (*Anser anser*)
- Herring gull (*Larus argentatus*)
- **Kingfisher (*Alcedo atthis*)**
- Lesser black-backed gull (*Larus fuscus*)
- **Little egret (*Egretta garzetta*)**
- Little grebe
- Mallard
- Moorhen (*Gallinula chloropus*)
- Mute swan
- Teal
- Tufted duck
- **White-tailed eagle (*Haliaeetus albicilla*)**
- **Whooper swan**
- Wigeon

5.1.1 Arctic tern

Arctic tern was observed during transect surveys in May 2021 and May 2022. The observation in 2021 was of eight Arctic tern in Scariff Bay to the west of Inis Cealtra.

Table 4. Arctic tern survey results

Location	Survey Type	2021	2022	Peak Count
		May	May	
Inis Cealtra	Transect	8*	2	8
	Peak Count	8	2	

* On May 2021 the observation of Arctic tern was recorded during the transect survey on Inis Cealtra, however they were observed in Scariff Bay to the west of the island.

5.1.2 Black-headed gull

Black-headed gull was observed on the mainland and on Inis Cealtra during the winter and breeding seasons. Peak count of 380 was observed on Inis Cealtra in May 2021.

Table 5. Black-headed gull survey results

Location	Survey Type	2021			2022								Peak Count
		Mar	May	Jun	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mainland	Mountshannon	0	0	0	0	0	0	0	0	8	12	2	85
	Field 1	0	0	0	0	0	0	0	0	0	0	85	
	Peak Count	0	0	0	0	0	0	0	0	8	12	85	
Inis Cealtra	Transect	40	380	6	76	20	18	5	4	1	0	6	380
	Peak Count	40	380	6	76	20	18	5	4	1	0	6	
Location	Survey Type	2023							2024		Peak Count		
		Jan	Feb	May	Jun	Jul	Aug	Sept	Feb	Mar			
Mainland	Mountshannon	1	2	25	30	1	1	1	4	0	50		
	Knockaporth	0	42	50	2	4	0	2	0	3			
	Field 1	1	0	0	0	0	0	0	0	0			
	Peak Count	1	42	50	30	4	1	2	4	3			
Inis Cealtra	Transect	0	0	11	0	0	0	1	0	2	11		
	Peak Count	0	0	11	0	0	0	1	0	2			

5.1.3 Buzzard

Buzzard was observed on the mainland by Knockaphort and on the island of Inis Cealtra.

Table 6. Buzzard survey results

Location	Survey Type	2021	2022	2023		Peak Count
		Mar	Mar	Jan	Jul	
Mainland	Mountshannon	0	0	0	1	1
	Peak Count	0	0	0	1	
Inis Cealtra	Transect	2*	2*	1	0	2
	Peak Count	2	2	1	0	

*On 16th March 2021, there was an incidental observation of a pair of buzzards made during the transect survey on Inis Cealtra. A pair were observed displaying in woodland near Knockaphort pier and slipway.

*On 1st March 2022, two buzzards were observed to the north behind Knockaphort during the transect survey on Inis Cealtra.

5.1.4 Common gull

Common gull was observed on the mainland and on Inis Cealtra during the winter and breeding seasons. A peak count of two was observed on Inis Cealtra in March 2021 and August 2022.

Table 7. Common gull survey results

Location	Survey Type	2021		2022	2023		2024	Peak Count
		Mar	Nov	Aug	Mar	July	Feb	
Mainland	Mountshannon	0	0	0	0	1	0	1
	Knockaphort	0	0	0	1	0	0	
	Peak Count	0	0	0	1	1	0	
Inis Cealtra	Transect	2	1	2	0	0	1	2
	Peak Count	2	1	2	0	0	1	

5.1.5 Common tern

Observations of common tern were made at Scariff Bay, from Knockaphort pier and around the island of Inis Cealtra.

Table 8. Common tern survey results

Location	Survey Type	2021		2022			2023	Peak Count
		May	Jun	May	Jun	Jul	Jun	
Mainland	Knockaphort	0	0	0	0	0	1	1
	Peak Count	0	0	0	0	0	1	
Inis Cealtra	Transect	38*	1*	4	4	*10	0	38
	Peak Count	38	1	4	4	10	0	

*On 5th May 2021 the peak count of 38 common tern were observed at Scariff bay.

*On 10th June 2021 common tern was observed fishing between Knockaport and Inish Cealtra.

*In July 2022 the surveyor noted disturbance to the species from visitors to the island.

5.1.6 Coot

Observations of the species occurred at Mountshannon harbour, from Knockaphort pier and around the island of Inis Cealtra.

Table 9. Coot survey results

Location	Survey Type	2021								Peak Count		
		Mar		May		Jun		Nov			Dec	
Mainland	Informal	0		0		0		0		14		14
	Peak Count	0		0		0		0		14		
Inis Cealtra	Transect	4		8		2		4		0		8
	Peak Count	4		8		2		4		0		
Location	Survey Type	2022								Peak Count		
		Jan	Mar	May	Jun	Jul	Oct	Nov	Dec			
Mainland	Mountshannon	0	0	0	0	0	12	2	0	12		
	Peak Count	0	0	0	0	0	12	2	0			
Inis Cealtra	Transect	10	8	4	4	3	0	0	2	10		
	Peak Count	10	8	4	4	3	0	0	2			
Location	Survey Type	2023								Peak Count		
		Jan	Feb	Mar	May	Jun	Jul	Aug	Sep			
Mainland	Mountshannon	1	1	2	2	2	2	7	0	8		
	Knockaphort	3	0	0	2	1	8	0	0			
	Peak Count	3	1	2	2	2	8	7	0			
Inis Cealtra	Transect	2	1	1	4	1	2	0	2	4		
	Peak Count	2	1	1	4	1	2	0	2			
Location	Survey Type	2024								Peak Count		
		Jan			Feb			Mar				
Mainland	Mountshannon	3			5			2		5		
	Knockaphort	0			0			3				
	Peak Count	3			5			3				
Inis Cealtra	Transect	2			7			5		7		
	Peak Count	2			7			5				

5.1.7 Cormorant

The peak count for cormorant was 32 and was observed from the mainland during informal counts in November 2021. Cormorant was observed roosting, flying over and foraging/feeding throughout the study area.

Table 10. Cormorant survey results

Location	Survey Type	2021					Peak Count
		Mar	May	Jun	Nov	Dec	
Mainland	Informal	0	0	0	32	4	32
	Peak Count	0	0	0	32	4	
Inis Cealtra	Transect	10	10	5	1	2	10
	Peak Count	10	10	5	1	2	
Location	Survey Type	2022					Peak Count

		Mar	May	Jul	Aug	Sep	Oct	Nov	Dec	
Mainland	Mountshannon	0	0	0	0	0	2	6	2	6
	Peak Count	0	0	0	0	0	2	6	2	
Inis Cealtra	Transect	4	2	5	1	3	2	0	2	5
	Peak Count	4	2	5	1	3	2	0	2	
Location	Survey Type	2023								Peak Count
		Jan	Feb	Mar	May	Jun	Jul	Aug	Sep	
Mainland	Mountshannon	1	0	0	1	0	1	1	1	8
	Knockaphort	0	0	1	0	0	0	8	0	
	Peak Count	1	0	1	1	0	1	8	1	
Inis Cealtra	Transect	1	2	1	0	1	0	1	1	2
	Peak Count	1	2	1	0	1	0	1	1	
Location	Survey Type	2024								Peak Count
		Jan			Feb		Mar			
Mainland	Mountshannon	1			1		3			3
	Knockaphort	1			3		1			
	Peak Count	1			3		3			
Inis Cealtra	Transect	2			0		2			2
	Peak Count	2			0		2			

5.1.8 Curlew

Curlew was heard calling and seen flying over Inis Cealtra. On 31st August the curlew recorded was observed flying over Inis Cealtra flying west towards Scariff Bay.

Table 11. Curlew survey results

Location	Survey Type	2021	2022	2023				Peak Count
		Nov	Aug	Feb	Mar	Aug	Sep	
Inis Cealtra	Transect	1	1	1	1	1	2	2
	Peak Count	1	1	1	1	1	2	

5.1.9 Golden plover

Golden plover was observed on Inis Cealtra during the winter transect counts in November 2021 and March 2022 with a peak count of 12. The flock of 12 were observed flying low over the water to the north of Inis Cealtra heading east towards the Tipperary side of Lough Derg.

Table 12. Golden plover survey results

Location	Survey Type	2021	2022	Peak Count
		Nov	Mar	
Inis Cealtra	Transect	1	12	12
	Peak Count	1	12	

5.1.10 Goldeneye

Goldeneye was generally sighted wintering on the mainland at Mountshannon harbour and from Knockaphort, and on the northern shoreline of Inis Cealtra, in and around the reed beds.

Table 13. Goldeneye survey results

Location	Survey Type	2021	2022			2023		Peak Count
		Dec	Jan	Nov	Dec	Jan	Feb	
Mainland	Informal	12	0	0	0	0	0	12
	Peak Count	12	0	0	0	0	0	
Mainland	Mountshannon	0	8	0	11	6	1	12
	Knockaphort	0	0	8	12	0	0	
	Peak Count	0	8	8	12	6	1	
Inis Cealtra	Transect	2	0	0	0	0	0	2
	Peak Count	2	0	0	0	0	0	

5.1.11 Great black-backed gull

Great black-backed gull were sighted on Inis Cealtra, from Knockaphort and on the mainland at Mountshannon.

Table 14. Great black-backed gull survey results

Location	Survey Type	2021	2022			2023		2024	Peak Count
		Jun	Jun	Jul	Nov	Jan	Aug	Feb	
Mainland	Mountshannon	0	0	0	0	1	1	0	2
	Knockaphort	0	0	0	0	0	0	2	
	Peak Count	0	0	0	0	1	1	2	
Inis Cealtra	Transect	1	2	2	1	0	1	0	2
	Peak Count	1	2	2	1	0	1	0	

5.1.12 Great crested grebe

Observations of this species occurred around the island of Inis Cealtra, from Knockaphort and at Mountshannon harbour.

Table 15. Great crested grebe survey results

Location	Survey Type	2021									Peak Count
		Mar	May	Jun	Nov	Dec					
Mainland	Informal	0	0	0	12	9	12				
	Peak Count	0	0	0	12	9					
Inis Cealtra	Transect	6	4	2	4	0	6				
	Peak Count	6	4	2	4	0					
Location	Survey Type	2022									Peak Count
		Jan	Mar	May	Jun	Jul	Sept	Oct	Nov	Dec	
Mainland	Mountshannon	4	0	0	0	0	0	2	0	2	4
	Peak Count	4	0	0	0	0	0	2	0	2	
	Transect	4	6	4	6	6	2	1	1	1	6

Inis Cealtra	Peak Count	4	6	4	6	6	2	1	1	1		
Location	Survey Type	2023							2024			Peak Count
		Jan	Feb	Mar	Jun	Jul	Aug	Sept	Jan	Feb	Mar	
Mainland	Mountshannon	2	2	0	2	1	2	3	0	4	5	5
	Knockaphort	0	0	1	1	2	1	1	1	0	2	
	Peak Count	2	2	1	2	2	2	3	1	4	5	
Inis Cealtra	Transect	0	1	1	0	3	0	0	1	1	3	3
	Peak Count	0	1	1	0	3	0	0	1	1	3	

5.1.13 Grey heron

Grey heron was observed on the mainland and on Inis Cealtra with a peak count of six observed on the mainland in November 2021.

Table 16. Grey heron survey results

Location	Survey Type	2021			2022			2023						Peak Count
		Mar	Nov	Dec	Jun	Oct	Nov	Mar	May	Jun	Jul	Aug	Sep	
Mainland	Informal	0	6	3	0	0	0	0	0	0	0	0	0	6
	Peak Count	0	6	3	0	0	0	0	0	0	0	0	0	
Mainland	Mountshannon	0	0	0	0	0	1	1	1	1	0	1	0	1
	Knockaphort	0	0	0	0	0	0	0	0	0	1	0	0	
	Peak Count	0	0	0	0	0	1	1	1	1	1	1	0	
Inis Cealtra	Transect	2	1	1	1	1	0	0	0	1	0	0	1	2
	Peak Count	2	1	1	1	1	0	0	0	1	0	0	1	

5.1.14 Grey wagtail

Grey wagtail was observed on Inis Cealtra in 2021 and in 2022 with a peak count of one observed.

Table 17. Grey Wagtail survey results

Location	Survey Type	2021	2022			Peak Count
		Dec	Jan	Jul	Oct	
Inis Cealtra	Transect	1	1	1	1	1
	Peak Count	1	1	1	1	

5.1.15 Greylag goose

Greylag Goose was observed on the mainland around Knockaphort, Mountshannon harbour and Field 1, and on Inis Cealtra with a peak count of 122 observed on the mainland in December 2022.

Table 18. Greylag goose survey results

Location	Survey Type	2021				2022	2023			2024	Peak Count
		Mar	May	Nov	Dec	Dec	Jul	Aug	Sep	Mar	
Mainland	Informal	0	0	80	1	0	0	0	0	0	80
	Peak Count	0	0	80	1	0	0	0	0	0	
Mainland	Mountshannon	0	0	0	0	0	0	0	0	1	122
	Knockaphort	0	0	0	0	6	0	0	3	1	
	Field 1	0	0	0	0	122	0	0	0	0	
	Peak Count	0	0	0	0	122	0	0	3	1	
Inis Cealtra	Transect	12*	8*	0	0	0	1	15	0	2	15
	Peak Count	12*	8*	0	0	0	1	15	0	2	

*On 16th March 2021, 12 were recorded during the transect survey on Inis Cealtra but were observed in the general area of Field 1 on the mainland with whooper swans.

*On 5th May 2021, eight were recorded during the transect survey on Inis Cealtra but were observed in the general area of Field 1 and in Field 2 on the mainland.

5.1.16 Hen harrier

Hen harrier was observed once, during the November 2021 transect survey on Inis Cealtra.

5.1.17 Herring gull

Herring gull was observed during the winter season on the mainland by Mountshannon harbour and during transects on Inis Cealtra.

Table 19. Herring Gull survey results

Location	Survey Type	2021	2022	2023	2024		Peak Count
		Nov	Nov	Jan	Jan	Feb	
Mainland	Mountshannon	0	0	1	1	1	1
	Peak Count	0	0	1	1	1	
Inis Cealtra	Transect	1	1	0	0	0	1
	Peak Count	1	1	0	0	0	

5.1.18 Jack snipe

One jack snipe was observed during the transect survey on Inis Cealtra on 21st February 2024.

5.1.19 Kestrel

During the shore count survey from Knockaphort in October 2022 there was an observation of a kestrel on the at Knockaphort.

5.1.20 Kingfisher

On 5th May 2021 a kingfisher was observed on Inis Cealtra as it flew off out of tall trees in a southeasterly direction. In August 2023 the sighting was of a single kingfisher at the pier on the east of the island of Inis Cealtra. In March 2024 a pair were observed flying and resting together on the banks of Lough Derg west of Mountshannon harbour.

Table 20. Kingfisher Survey results

Location	Survey Type	2021	2023	2024	Peak Count
		May	Aug	Mar	
Mainland	Mountshannon	0	0	2	2
	Peak Count	0	0	2	
Inis Cealtra	Transect	1	1	0	1
	Peak Count	1	1	0	

5.1.21 Lapwing

Observations of lapwing were made on the mainland during the winter seasons of 2022, 2023 and 2024. No observations were made on Inis Cealtra.

Table 21. Lapwing survey results

Location	Survey Type	2022		2023	2024		Peak Count
		Oct	Dec	Jan	Jan	Feb	
Mainland	Mountshannon	13	0	0	0	1	57
	Field 1	0	57	24	30	0	
	Peak Count	13	57	24	30	1	

5.1.22 Lesser black-backed gull

Lesser black-backed gull was observed on the mainland and on Inis Cealtra. The peak count for this species was two which were observed on Inis Cealtra during the transect survey in March 2021.

Table 22. Lesser Back-backed gull survey results

Location	Survey Type	2021		2022		2023			2024		Peak Count
		Mar	Nov	Mar	Nov	Feb	Jul	Aug	Feb	Mar	
Mainland	Mountshannon	0	0	0	1	1	0	0	1	0	1
	Knockaphort	0	0	0	0	0	1	1	0	1	
	Peak Count	0	0	0	1	1	1	1	1	1	
Inis Cealtra	Transect	2	1	1	0	0	1	0	0	0	2
	Peak Count	2	1	1	0	0	1	0	0	0	

5.1.23 Little egret

Little egret was observed in many locations throughout the study area, including Inis Cealtra, Mountshannon, Knockaphort and at Field 1 and Field 2 survey locations. The peak count was six made from Knockaphort in August 2023.

Table 23. Little egret survey results

Location	Survey Type	2021		2022	2023			Peak Count
		Nov	Dec	Nov	Jul	Aug	Sep	
Mainland	Informal	3	2	0	0	0	0	3
	Peak Count	3	2	0	0	0	0	
Mainland	Mountshannon	0	0	0	0	2	1	6
	Knockaphort	0	0	0	1	6	0	
	Field 1	0	0	2	0	0	0	
	Field 2	0	0	2	0	0	0	
	Peak Count	0	0	2	1	6	1	
Inis Cealtra	Transect	2	0	0	0	1	0	2
	Peak Count	2	0	0	0	1	0	

5.1.24 Little grebe

Little grebe was observed on the island of Inis Cealtra and on the mainland. The peak count was five, observed in December 2021 from the mainland during the informal survey on the mainland. In May 2023 five were also observed from Inis Cealtra. During the shore count surveys in summer 2023 little grebe were recorded as foraging, breeding and roosting in reedbeds and marsh.

Table 24. Little grebe survey results

Location	Survey Type	2021				2022						Peak Count
		Mar	Jun	Nov	Dec	Jan	Mar	May	Aug	Oct	Nov	
Mainland	Informal	0	0	0	5	0	0	0	0	0	0	5
	Peak Count	0	0	0	5	0	0	0	0	0	0	
Mainland	Mountshannon	0	0	0	0	3	0	0	0	1	1	3
	Peak Count	0	0	0	0	3	0	0	0	1	1	
Inis Cealtra	Transect	2	2	3	0	3	4	2	1	1	0	4
	Peak Count	2	2	3	0	3	4	2	1	1	0	
Location	Survey Type	2023					2024			Peak Count		
		Jan	May	Jul	Aug	Sept	Jan	Mar				
Mainland	Mountshannon	4	0	0	0	0	0	4	4	4		
	Knockaphort	4	5	1	2	1	0	3				
	Peak Count	4	5	1	2	1	4	4				
Inis Cealtra	Transect	1	0	0	3	1	0	3	3			
	Peak Count	1	0	0	3	1	0	3				

5.1.25 Mallard

Mallard was observed on the mainland and on Inis Cealtra. On 15th December 2021, 51 were observed during the informal survey on the mainland. On 14th June 2022, seven mallard were observed, four of which were chicks.

Table 25. Mallard survey results

Location	Survey Type	2021					2022						Peak Count
		Mar	May	Jun	Nov	Dec	May	Jun	Jul	Sep	Nov	Dec	

Mainland	Informal	0	0	0	0	51	0	0	0	0	0	0	51
	Peak Count	0	0	0	0	51	0	0	0	0	0	0	
Inis Cealtra	Transect	8	16	1 0	12	0	1	7	4	3	2	8	16
	Peak Count	8	16	1 0	12	0	1	7	4	3	2	8	
Location	Survey Type	2023					2024					Peak Count	
		Feb	Mar	May	Aug	Jan	Feb	Mar					
Mainland	Mountshannon	0	0	0	0	3	0	0	4				
	Knockaphort	0	2	0	0	0	4	1					
	Peak Count	0	2	0	0	3	4	1					
Inis Cealtra	Transect	4	4	2	2	0	11	6	11				
	Peak Count	4	4	2	2	0	11	6					

5.1.26 Meadow pipit

Meadow pipit were observed during transect surveys on Inis Cealtra. A peak count of 15 was recorded during the transect surveys in November 2021.

Table 26. Meadow pipit survey results

Location	Survey Type	2021				2022					2023		Peak Count
		Mar	May	Nov	Dec	Jan	Sep	Oct	Nov	Dec	Jan	Sep	
Inis Cealtra	Transect	1	1	15	3	2	9	13	4	2	2	4	15
	Peak Count	1	1	15	3	2	9	13	4	2	2	4	

5.1.27 Moorhen

Moorhen was observed on the mainland and on Inis Cealtra the winter and breeding seasons. The peak count was 12 observed from the mainland in December 2021 during the informal survey.

Table 27. Moorhen survey results

Location	Survey Type	2021			2022				Peak Count
		Mar	May	Dec	Jan	Jun	Jul	Nov	
Mainland	Informal	0	0	12	0	0	0	0	12
	Peak Count	0	0	12	0	0	0	0	
Inis Cealtra	Transect	3	3	3	5	5	2	1	5
	Peak Count	3	3	3	5	5	2	1	
Location	Survey Type	2023				2024		Peak Count	
		Jan	Jul	Aug	Sept	Mar			
Mainland	Mountshannon	0	0	0	0	1		1	
	Knockaphort	0	1	0	0	1			
	Peak Count	0	1	0	0	1			
Inis Cealtra	Transect	1	0	1	1	1		1	
	Peak Count	1	0	1	1	1			

5.1.28 Mute swan

Mute swan was observed numerous times throughout the study area between March 2021 and March 2024. The peak count was 38 observed on the mainland on 25th November 2021, during the informal survey. On 15th December 2021, 23 were observed during the informal survey. Sightings of this species were made at the location of the proposed new mooring site on Inis Cealtra, Knockaphort and at Mountshannon harbour. These numbers include many cygnets of varying ages. A breakdown of mute swan peak counts are displayed in **Table 28**, below.

Table 28. Mute Swan survey results

Location	Survey Type	2021									Peak Count
		Mar		Jun		Nov		Dec			
Mainland	Informal	0		0		38		23		38	
	Peak Count	0		0		38		23			
Inis Cealtra	Transect	4		32		8		4		32	
	Peak Count	4		32		8		4			
Location	Survey Type	2022									Peak Count
		Jan	Mar	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mainland	Mountshannon	4	0	0	0	0	0	0	0	0	4
	Knockaphort	0	0	0	0	0	0	0	1	0	
	Field 1	0	0	0	0	0	0	0	1	4	
	Peak Count	4	0	0	0	0	0	0	1	4	
Inis Cealtra	Transect	6	20	16	4	14	18	4	0	5	20
	Peak Count	6	20	16	4	14	18	4	0	5	
Location	Survey Type	2023								Peak Count	
		Jan	Feb	Mar	May	Jun	Jul	Aug	Sep		
Mainland	Mountshannon	6	0	0	3	10	8	16	2	23	
	Knockaphort	2	0	1	2	18	23	16	2		
	Field 1	0	0	10	0	0	0	0	0		
	Peak Count	6	0	10	3	18	23	16	2		
Inis Cealtra	Transect	4	2	2	4	11	1	20	3	20	
	Peak Count	4	2	2	4	11	1	20	3		
Location	Survey Type	2024							Peak Count		
		Jan		Feb			Mar				
Mainland	Mountshannon	3		2			2		4		
	Knockaphort	0		2			4				
	Peak Count	3		2			4				
Inis Cealtra	Transect	0		2			4		4		
	Peak Count	0		2			4				

5.1.29 Pintail

Eight pintail were observed on during transects on Inis Cealtra on 31st January 2022.

5.1.30 Pochard

Pochard was sighted once in the reedbeds at Mountshannon harbour among a flock of tufted duck during the March 2024 shore count survey.

5.1.31 Red-breasted merganser

Red-breasted merganser was observed on Inis Cealtra in March 2021 and 2024. In 2021 a female was observed to the northeast side of island. This bird was joined by a flock of tufted ducks.

5.1.32 Redshank

Redshank was observed once, during the November 2021 transect survey effort on Inis Cealtra.

5.1.33 Redwing

Redwing were observed wintering on the island of Inis Cealtra. Redwing were generally heard and/or observed flying over during transect surveys. Redwing were observed using the woodland and scrub habitats throughout the island (see habitat map in **Appendix 1**).

Table 29. Redwing survey results

Location	Survey Type	2021		2022			2023		2024		Peak Count
		Nov	Dec	Mar	Oct	Dec	Jan	Feb	Jan	Feb	
Inis Cealtra	Transect	7	7	7	1	6	17	7	11	4	17
	Peak Count	7	7	7	1	6	17	7	11	4	

5.1.34 Shoveler

Shoveler was observed during the shore count survey in May 2023 from Knockaphort pier and at Mountshannon harbour. 10 were observed nine of which were ducklings using the reedbeds at Knockaphort and two were observed at Mountshannon.

5.1.35 Snipe

Snipe were exclusively observed on the island of Inis Cealtra. Snipe were generally flushed or observed flying over during transect surveys. Snipe were mainly observed using the marsh habitats on the island (see habitat map in **Appendix 1**).

Table 30. Snipe survey results

Location	Survey Type	2021			2022				2023		2024		Peak Count
		Mar	May	Nov	Jan	Mar	Sep	Nov	Jan	Mar	Jan	Mar	
Inis Cealtra	Transect	2	1	5	5	1	2	3	2	1	1	1	5
	Peak Count	2	1	5	5	1	2	3	2	1	1	1	

5.1.36 Sparrowhawk

Two observations of sparrowhawk were recorded in total during transect surveys of Inis Cealtra. One immature sparrowhawk was observed in August 2022, and one sparrowhawk was observed in October 2022.

5.1.37 Swift

Thirteen observations of swift were recorded in total during transect surveys of Inis Cealtra. Six individuals were observed in June 2021, and seven individuals were observed in July 2022.

5.1.38 Teal

Observations of this species were made during surveys on the mainland and on Inis Cealtra. Teal were observed in 2021 and 2022 with a peak count of 10 made during December 2021 during the informal survey on the mainland.

Table 31. Teal survey results

Location	Survey Type	2021		2022		Peak Count
		Nov	Dec	Jan	Aug	
Mainland	Informal	0	10	0	0	10
	Peak Count	0	10	0	0	
Inis Cealtra	Transect	6	0	5	8	8
	Peak Count	6	0	5	8	

5.1.39 Tufted duck

Tufted duck were generally sighted at Mountshannon harbour and from Knockaphort, and on the northern shoreline of Inis Cealtra, in and around the reed beds. On 15th December 2021, the peak count of 160 were observed during the informal survey on the mainland.

Table 32. Tufted duck survey results

Location	Survey Type	2021		2022					Peak Count
		Mar	Dec	Jan	Mar	Oct	Nov	Dec	
Main land	Informal	0	160	0	0	0	0	0	160
	Peak Count	0	160	0	0	0	0	0	
Main land	Mountshannon	0	0	16	0	34	28	41	122
	Knockaphort	0	0	0	0	1	122	0	
	Peak Count	0	0	16	0	34	122	41	
Inis Cealtra	Transect	12	68	48	25	2	0	0	68
	Peak Count	12	68	48	25	2	0	0	
Location	Survey Type	2023				2024			Peak Count
		Jan	Feb	Mar	Sep	Jan	Feb	Mar	
Main land	Informal	0	0	0	0	0	0	0	0
	Peak Count	0	0	0	0	0	0	0	
Main land	Mountshannon	21	38	12	0	40	15	6	40
	Knockaphort	38	33	18	6	0	9	0	
	Peak Count	38	38	18	6	40	15	6	
Inis Cealtra	Transect	1	0	2	0	0	26	5	26

5.1.40 White-tailed eagle

White-tailed eagle was observed a total of nine times (two of these observations were incidental observations of a pair). In November 2021 an adult was observed during the informal survey on the mainland. In December 2021 an individual was observed perched in a tree to the west side of Inis Cealtra Island. In January 2022 an adult male was observed on the mainland. In September 2023 following an incidental observation a third individual was observed flying over Mountshannon harbour and over Inis Cealtra. The final observation was made of an individual observed on Inis Cealtra in February 2024

Table 33. White-tailed eagle survey results

Location	Survey Type	2021		2022	2023		2024	Peak Count
		Nov	Dec	Jan	Mar	Sep	Feb	
Mainland	Informal	1	0	0	0	0	0	1
	Peak Count	1	0	0	0	0	0	
Mainland	Mountshannon	0	0	1	0	1	0	2
	Knockaphort	0	0	0	2*	2*	1	
	Peak Count	0	0	1	2	2	1	
Inis Cealtra	Transect	0	1	0	0	0	0	1
	Peak Count	0	1	0	0	0	0	

* In March and September 2023 there were two incidental observations of white-tailed eagle made. On both occasions a pair were observed perching in a tree on the neighbouring Young Island these observations were made during the survey at Knockaphort.

5.1.41 Whimbrel

One whimbrel was observed in May 2021 during the transect survey on the south shore of Inis Cealtra.

5.1.42 Whooper swan

A total of 422 observations of whooper swan were recorded during survey efforts and the peak count was 103.

Table 34. Whooper Swan survey results

Location	Survey Type	2021			2022			2023		2024		Peak Count
		Mar	Nov	Dec	Jan	Nov	Dec	Jan	Mar	Jan	Feb	
Mainland	Informal	0	41	31	0	0	0	0	0	0	0	41
	Peak Count	0	41	31	0	0	0	0	0	0	0	
Mainland	Field 1	0	0	0	9	17	103	57	34	39	52	103
	Field 2	0	0	0	22	0	0	0	0	0	0	
	Knockaphort	0	0	0	0	0	0	0	0	5	0	
	Peak Count	0	0	0	0	17	103	57	34	39	52	
Inis Cealtra	Transect	12*	0	0	0	0	0	0	0	0	0	12*
	Peak Count	12*	0	0	0	0	0	0	0	0	0	

*On 16th March 2021, 12 swans observed were recorded during the transect survey on Inis Cealtra but were observed in Field 1. In January 2024 five whooper swans were observed flying over Inis Cealtra.

5.1.43 Wigeon

On 15th December 2021, 60 wigeon were observed during an informal survey on the mainland. Two wigeon were observed in March 2023 during transect surveys on Inis Cealtra.

6. Discussion

See **Appendix 4** for data on the various species observed in the Winter vs Summer/on the Island of Inis Cealtra vs the Mainland 'Winter season and Summer season survey results for wetland and waterbirds.' See **Appendix 5** for data on 'Winter season and Summer season survey results for non-wetland and non-waterbirds'.

Waders and Waterbirds

Of the 35 wader and waterbird species recorded during the overall survey period, four were only recorded in the summer season. These include Arctic tern, common tern, shoveler and whimbrel.

Eleven were only recorded in the winter season, namely golden plover, goldeneye, herring gull, jack snipe, lapwing, pintail, pochard, red-breasted merganser, redshank, whooper swan and wigeon.

The remainder (black-headed gull, common gull, coot, cormorant, curlew, great black-backed gull, great crested grebe, grey heron, grey wagtail, greylag goose, kingfisher, lesser black-backed gull, little egret, little grebe, mallard, moorhen, mute swan, snipe, teal and tufted duck), were recorded in both summer and winter seasons.

Summer season observations

Species such as Arctic tern and common tern are only summer visitors to Ireland and do not overwinter here. Arctic tern is mainly a coastal breeding bird, with colonies found on the west coast having the largest number of birds, but in Ireland the species also breeds inland on the freshwater lakes of Lough Corrib (Co. Galway) and Lough Conn (Co. Mayo). Arctic tern was only recorded during summer season island surveys, with a total count of 10 sightings recorded during Transect surveys over the survey period. Two Arctic tern were recorded on Inis Cealtra and eight were observed in Scariff Bay west of the island..

Common tern also generally breeds on the coast, with larger colonies in Co. Dublin, Co. Wexford and Co. Galway, although also breeds inland on islets in freshwater lakes, notably in Co. Galway and in Co. Mayo. Lough Derg supports a nationally important breeding colony of common tern (55 pairs recorded in 1995). Management of one of the islands used for nesting has increased the area of suitable habitat available and prevented nests being destroyed by fluctuating water levels (NPWS, 2014). During surveys, common tern was recorded in the summer (May, June and July) during both Inis Cealtra and mainland surveys, although it is not breeding on Inis Cealtra. Sightings were made from Scariff Bay and Knockaphort on the mainland. The total number of sightings for this species across the overall survey period was 58.

Shoveler has a localised breeding distribution in Ireland, centred around Lough Neagh and the mid-Shannon basin. Shoveler was very rarely recorded (May 2023 only), when a family group was recorded in Knockaphort and Mountshannon harbour.

Whimbrel is a non-breeding species in Ireland, occurring as a passage migrant in spring and autumn. Although whimbrel may winter in Ireland, their main wintering range is outside of Ireland. Whimbrel was also very rarely recorded (one record on the island, May 2021). This species was not recorded during any of the mainland counts.

Winter season observations

Golden plover have a relatively widespread non-breeding distribution and a very localised breeding distribution in the west and northwest of Ireland. In winter they are regularly found in large, densely-packed flocks, and in a variety of habitats, both coastal and inland. Golden plover were only observed during island surveys in the winter (November and March) seasons. A total count of 13 was made during the transect surveys.

Goldeneye non-breeding distribution is very localised in Ireland, and they have a small breeding distribution restricted to the north-east. In winter Lough Derg, has nationally important populations of goldeneye (157) –

figures are mean peaks for 4 of 5 seasons between 1995/96 and 1999/2000 (NPWS 2014). They have been observed on Inis Cealtra and the mainland only during the winter seasons (total count 60).

Herring gull are predominantly a coastal breeding bird with a widespread coastal distribution. They have been observed during both mainland and island surveys during the winter (total count 5) seasons.

Jack snipe do not breed in Ireland. They winter all over Ireland and are present between September and March. Jack snipe was only observed during island surveys in winter (total count 1).

Lapwing have a widespread breeding and wintering distribution, breeding mainly in the centre and Northern half of the country. They breed in open farmland habitat. Lapwing were recorded during mainland surveys in winter seasons (total count 163).

Pintail are a non-breeding species in Ireland, however one pair have been recorded in County Down in 1994⁹. In winter, they form large flocks on brackish coastal lagoons, in estuaries and on large inland lakes. Pintail were recorded during transect surveys on Inis Cealtra in the winter season (total count 8).

Pochard is a scarce summer visitor and widespread winter migrant - most occur between October & February. One pochard was the only target species recorded in winter during mainland surveys only which occurred at Mountshannon harbour.

Red-breasted merganser have a localised breeding distribution mainly in the west and north of Ireland. They were observed during island surveys in the winter seasons (total count 2).

Redshank breeds mainly in the midlands (especially Shannon Callows) and northern half of the country, but not commonly anywhere in Ireland. Redshank was only observed during island surveys in winter season (total count 1).

Whooper swan are predominantly a non-breeding species in Ireland. They are however a relatively widespread winter migrant found on lowland open farmland around inland wetlands. Whooper swan were observed on the mainland and flying over Inis Cealtra in the winter seasons (total count 417).

Wigeon has a highly localised breeding distribution on shallow freshwater marshes, under tussocks adjacent to lakes and lagoons or on lake islands. They have a widespread wintering distribution where they occur on coastal habitats and brackish lagoons, estuaries and bays. Wigeon were observed during mainland and island surveys in the winter season (total count 62).

Summer and winter season observations

Black-headed gull breeds both on the coast and inland in small numbers on islands in larger lakes in western Ireland. They are known to breed on several offshore islands in Lough Derg¹⁰, with large numbers having traditionally bred on the many islands (2,176 pairs in 1985) (NPWS, 2014). Black-headed gull was recorded during both mainland and island surveys during the winter and summer seasons. The greatest numbers were recorded in summer (total count 637), although numbers were still relatively high during the winter months (total count 209).

Common gull is a locally breeding species on islands in larger lakes in western Ireland where it nests on the ground. Inland breeding populations have declined, attributed to predation by mink. Common gull was infrequently recorded during the winter surveys of the island (total count 7) and summer season mainland surveys (total count 1).

Coot is a resident species at ponds and lakes throughout Ireland. The breeding distribution is relatively widespread. Coot are known to breed on Lough Derg and there is an abundance of suitable fringing habitat

⁹ [Pintail - BirdWatch Ireland](#) Available 03.10.2024

¹⁰ <https://www.clarecoco.ie/services/planning/publications/heritageconservation/lough-derg-on-the-shannon-nature-trail-24579.pdf> Available 01.10.2024

available. Coot was recorded during both mainland and island surveys in both summer (total count 54) and winter (total count 94).

Cormorant mainly have a coastal breeding distribution in Ireland, although there are some inland breeding populations. At Lough Derg, cormorants form breeding colonies in trees around the lake. Islands within Lough Derg (Bear Island, Crane Island and Carrigeen Island) support a nationally important breeding population of cormorant. A large colony also nests on offshore islands near Rinmaher, Portumna. During bird surveys, cormorants were recorded during both mainland and island surveys in both winter (total count 87) and summer (total count 41).

Curlew is a rare breeder in floodplains and boglands across much of the country. In winter, Lough Derg supports a wintering population. During bird surveys, curlew was only recorded during island surveys where it was infrequently recorded in both winter (total count 3) and summer (total count 4). Curlew was not recorded during any of the mainland surveys.

Great black-backed gull has a coastal breeding distribution, breeding in colonies all around the coast of Ireland. A few birds breed inland where they associate with freshwater lakes in Co. Mayo and Co. Galway. Great black-backed gull was infrequently recorded from both the mainland and island in both winter (total count 3) and summer (total count 7).

Great crested grebe has a relatively widespread breeding distribution in Ireland, which includes large, shallow eutrophic loughs. Lough Derg is a noted breeding site for this species with an abundance of suitable fringing habitat. In 1995, 47 pairs were recorded (NPWS, 2014). Great crested grebe was recorded during both mainland and island surveys in the winter (total count 76) and summer (total count 40).

Grey heron has a widespread breeding distribution in Ireland and are found in the same wetland habitats during the winter as in the breeding season. Grey heron was recorded during both mainland and island surveys in the winter (total count 16) and summer (total count 7).

Greylag geese are winter migrants with Icelandic birds migrating to Ireland in winter between November and April and feral birds are present all year around. Greylag goose has a localised breeding distribution in Ireland, which includes lakes and reservoirs. Greylag goose was observed in high numbers during both mainland and island surveys in the winter (total count 225) and summer (total count 27)

Kingfisher has a widespread breeding distribution in Ireland. They breed banks along streams and rivers and are a resident species in Ireland and rarely move from their territories. However, during winter, some may move to lakes and coasts during extended spells of poor weather. Kingfisher was observed during mainland surveys in winter (total count 2) and during island surveys in summer (total count 2) .

Lesser black-backed gull has a coastal breeding distribution mostly on the west coast. They breed colonially, often with other gull species especially herring gull. Lesser black-backed gull nest on the ground and will use a variety of sites, including off shore islands, islands in inland lakes, sand dunes and coastal cliffs. Most inland colonies are found in Co. Mayo and in Co. Donegal. Lesser black-backed gull was observed during both mainland and island surveys in winter (total count 8) and summer (total count 3).

Little egret has mainly a coastal breeding distribution concentrated in the south of Ireland. They can be found throughout the year along coasts and rivers throughout Ireland, but still scarce in the midlands and north-west of the country. Rare until it first started breeding here in 1997 and now occurs in almost every coastal county, as well as at a number of inland sites. Little egret was observed during both mainland and island surveys in winter (total count 11) and summer (total count 11).

Little grebe breeding sites are relatively widely scattered with slightly higher densities in the northeast of Ireland. Lough Derg provides suitable fringing habitat. Little grebe was observed during both mainland and island surveys in winter (total count 46) and summer (total count 18).

Mallard has a very widespread breeding population in Ireland where nest sites vary, mostly in ground where they are hidden in vegetation. Mallard was observed during both mainland and island surveys in winter (total count 116) and summer (total count 45).

Moorhen is the most common of our river birds. They nest near water, usually in emergent vegetation or on a floating raft. Moorhen are widespread throughout the country, only in parts of the west is it absent or rare. Moorhen was observed during both mainland and island surveys in winter (total count 28) and summer (total count 13)..

Mute swan breeding distribution is widespread throughout Ireland in lakes, ponds and rivers. They have previously been recorded on Lough Derg during the winter season¹¹. Mute swan was observed during both mainland and island surveys in winter (total count 174) and summer (total count 223).

Snipe breeding distribution is widespread in Ireland concentrated mainly in the west of the country. They nest on the ground, usually concealed in a grassy tussock, in or near wet or boggy terrain. Snipe was only observed during island surveys in winter (total count 21) and summer (total count 3).

Teal breeding distribution is widespread throughout Ireland near small freshwater lakes or pools and small upland streams away from the coast. Teal were recorded during both mainland and island surveys in winter (total count 21) and only on the island in the summer (total count 8).

Tufted duck has a widespread breeding distribution in Ireland showing a preference for large open lakes in lowland areas, where nests are built in waterside vegetation. They been noted as a breeding species in Lough Derg. In May 1995 169 pairs were recorded (NPWS, 2014). Tufted duck was observed during both mainland and island surveys winter in high numbers (total count 833) and summer (total count 6).

Non-wader and non-waterbirds

Buzzard were to be found breeding mainly in the north and east of country, north of a line from Co. Sligo to Co. Wexford until quite recently. . Now they are widespread where birds nest in trees, usually with access to open land including farmland, moorland and wetland. This species has spread slowly down from the north through the twentieth century. Buzzard were observed during island surveys in winter (total count 5*) and during mainland surveys in summer seasons (total count 1). *Two incidental observations of a pair of buzzards were observed near Knockaphort pier during transect surveys on the island.

Hen harrier breeding distribution is confined largely to heather moorland and young forestry plantations, where they nest on the ground. They are found mainly in counties Laois, Tipperary, Cork, Clare, Limerick, Galway, Monaghan, Cavan, Leitrim, Donegal and Kerry. The species has declined, probably due to the loss of quality moorland habitat. Winters in more coastal and lowland areas throughout Ireland. They are also known to roost in the reedbeds on the margins of the Lough Derg SPA during the winter (NPWS, 2014). Hen harrier was only observed during island surveys in winter 2021 (total count 1).

Kestrel are a widespread breeder throughout the country. Found in wide variety of open habitats including coasts, moor land, farmland, wetlands, roadside verges and town parks. During the winter they are largely resident within their breeding territory. Kestrel was observed on the mainland at Knockaphort in October 2022.

Meadow Pipit is a very widespread breeding species in Ireland, with around 500,000 to 1,000,000 pairs. Found in bogs, uplands and areas of scrub and pasture. They were a frequently recorded species only observed during island surveys in the winter (total count 42), and summer (total count 14).

Redwing does not breed in Ireland. They are a common winter visitor to Ireland arriving in October and departing again between mid-March and early-April. Redwing favours open fields in lowland areas but tends to avoid urban areas. Redwing were therefore only recorded during the winter (total count 67) observed during island surveys.

¹¹ [SITE SYNOPSIS \(npws.ie\)](https://www.npws.ie) Available 03.10.2024

Sparrowhawk breed throughout Ireland but is scarce in the west, where tree cover is low. Resident species seen throughout the country in winter, although numbers will be low in some parts of the west. Irish birds will be joined by wintering birds from Britain and Europe. Sparrowhawk was observed during island surveys in the 2022 winter (total count 2).

Swift breed throughout Ireland, usually in small recesses in buildings, and less frequently in holes in trees or caves in uplands or coastal areas. Migrants arrive from the end of April and are present up until the start of September. Swift were observed only during island surveys in summer (total count 13).

White-tailed eagle is a resident in Ireland. There has been mixed success in terms of breeding in Ireland since the recent reintroduction at Killarney National Park in 2007, Mountshannon and Portumna. Formerly a widespread resident along all Irish coasts and historically they were a widespread breeding species. White-tailed eagle was observed during both mainland and island surveys in winter (total count *6) and summer (total count *3). *Four were incidental observations of two pairs on the neighbouring Young Island. One pair was observed in the winter and the other during the summer months in 2023.

7. Summary

- A total of 83 bird species were recorded onsite during the survey effort.
- 43 target species, of which 35 are wetland and waterbirds.
- 40 passerine birds.
- Five raptors (buzzard, hen harrier, kestrel, sparrowhawk, white-tailed eagle).
- Peak counts for SCI's:
 - Common Tern – 38 observed in Scariff Bay during transects on Inis Cealtra in May 2021
 - Cormorant – 32 observed from the mainland in November 2021
 - Goldeneye – 12 observed from the mainland in December 2021 and from Knockaphort in December 2022
 - Hen Harrier – Only one observed on Inis Cealtra in November 2021 and
 - Tufted Duck – 160 observed from the mainland in December 2021.

Other findings of note include:

- Reedbeds and marsh are an important habitat for wetland and waterbirds using the study area.
- The woodland and scrub habitats are of major significance for biodiversity as they are uncommon and support a diverse community of breeding and wintering birds on the island. Red-listed birds such as the curlew, golden plover, grey wagtail, meadow pipit, redshank, redwing, snipe and swift were only recorded on the island and not during mainland surveys.
- Of the 35 wader and waterbird species recorded during the overall survey period, four were only recorded in the summer season, eleven were only recorded in the winter season and the remaining twenty were recorded in both the summer and winter seasons.
- The island of Inis Cealtra had a wide variety of habitats suitable for both wintering and breeding birds. Scrub, woodland, stone buildings, marsh and grasslands provide ample breeding and foraging habitat for passerines in particular. For example, raven was recorded nesting in the round tower, and swallows were likely nesting in the monastic ruins.

8. References

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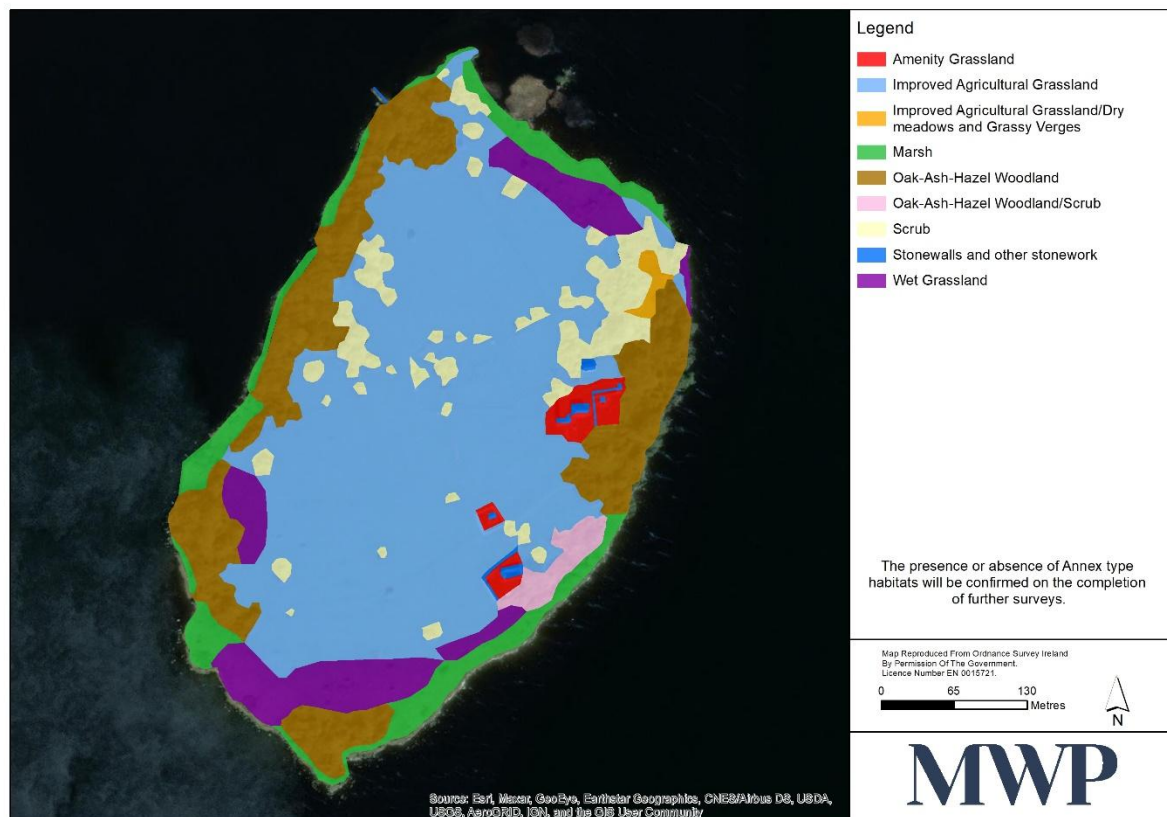
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9. Appendices



Appendix 1. Habitat Map of the island of Inis Cealtra on Lough Derg, (River Shannon).

Appendix 2. Breeding Bird Atlas data (R68 & R78) with breeding and wintering status

Species Name	Breeding Atlas (07-11)	Wintering Atlas (07-11)	Conservation Status ¹²
Barn Swallow (<i>Hirundo rustica</i>)	Confirmed	-	AL
Blackbird (<i>Turdus merula</i>)	Confirmed	Present	GL
Blackcap (<i>Sylvia atricapilla</i>)	Confirmed	Present	GL
Black-headed Gull (<i>Larus ridibundus</i>)	Possible	Present	AL
Blue Tit (<i>Cyanistes caeruleus</i>)	Confirmed	Present	GL
Brambling (<i>Fringilla montifringilla</i>)	-	Present	AL
Bullfinch (<i>Pyrrhula pyrrhula</i>)	Confirmed	Present	GL
Chaffinch (<i>Fringilla coelebs</i>)	Confirmed	Present	GL
Chiffchaff (<i>Phylloscopus collybita</i>)	Confirmed	-	GL
Coal Tit (<i>Periparus ater</i>)	Confirmed	Present	GL
Collared Dove (<i>Streptopelia decaocto</i>)	Probable	Present	GL
Common Gull (<i>Larus canus</i>)	Possible	Present	AL
Common Snipe (<i>Gallinago gallinago</i>)	Present	Present	RL
Common Tern (<i>Sterna hirundo</i>)	Possible	-	AL, BD, SCI
Coot (<i>Fulica atra</i>)	Confirmed	Present	AL
Cormorant (<i>Phalacrocorax carbo</i>)	Possible	Present	AL, SCI
Cuckoo (<i>Cuculus canorus</i>)	Possible	-	GL
Curlew (<i>Numenius arquata</i>)	Present	Present	RL
Fieldfare (<i>Turdus pilaris</i>)	-	Present	GL
Gadwall (<i>Anas strepera</i>)	Possible	Present	AL
Goldcrest (<i>Regulus regulus</i>)	Probable	Present	AL
Golden Plover (<i>Pluvialis apricaria</i>)	Present	Present	RL, BD
Goldeneye (<i>Bucephala clangula</i>)	Present	Present	RL, SCI
Goldfinch (<i>Carduelis carduelis</i>)	Possible	Present	GL
Grasshopper Warbler (<i>Locustella naevia</i>)	Possible	-	GL
Great Black-backed Gull (<i>Larus marinus</i>)	-	Present	GL
Great Crested Grebe (<i>Podiceps cristatus</i>)	Probable	Present	AL
Great Tit (<i>Parus major</i>)	Confirmed	Present	GL
Greater Scaup (<i>Aythya marila</i>)	Present	Present	RL
Greenfinch (<i>Carduelis chloris</i>)	Possible	Present	AL
Grey Heron (<i>Ardea cinerea</i>)	Possible	Present	GL
Grey Wagtail (<i>Motacilla cinerea</i>)	Confirmed	Present	RL
Greylag Goose (<i>Anser anser</i>)	Possible	-	AL
Hedge Accentor (<i>Prunella modularis</i>)	Confirmed	Present	GL
Hen Harrier (<i>Circus cyaneus</i>)	Possible	Present	AL, IV, SCI, BD
Herring Gull (<i>Larus argentatus</i>)	-	Present	AL
Hooded Crow (<i>Corvus cornix</i>)	Possible	Present	GL
House Martin (<i>Delichon urbicum</i>)	Confirmed	-	AL
House Sparrow (<i>Passer domesticus</i>)	Confirmed	Present	AL

¹² Conservation Status: BD = Annex I of the Birds Directive; RL = BoCCI Red-listed; SCI = Species Conservation Interest of nearby SPA; Schedule IV = protected under Schedule IV of the Wildlife Act

Species Name	Breeding Atlas (07-11)	Wintering Atlas (07-11)	Conservation Status ¹²
Jackdaw (<i>Corvus monedula</i>)	Confirmed	Present	GL
Jay (<i>Garrulus glandarius</i>)	Possible	Present	GL
Kestrel (<i>Falco tinnunculus</i>)	Possible	Present	RL
Kingfisher (<i>Alcedo atthis</i>)	Confirmed	Present	AL, BD
Lapwing (<i>Vanellus vanellus</i>)	Possible	Present	RL
Lesser Redpoll (<i>Carduelis cabaret</i>)	Possible	Present	GL
Linnet (<i>Carduelis cannabina</i>)	Confirmed	-	AL
Little Egret (<i>Egretta garzetta</i>)	Present	Present	GL, BD
Little Grebe (<i>Tachybaptus ruficollis</i>)	Confirmed	Present	GL
Long-tailed Tit (<i>Aegithalos caudatus</i>)	Confirmed	Present	GL
Magpie (<i>Pica pica</i>)	Possible	Present	GL
Mallard (<i>Anas platyrhynchos</i>)	Probable	Present	AL
Meadow Pipit (<i>Anthus pratensis</i>)	Possible	Present	RL
Mistle Thrush (<i>Turdus viscivorus</i>)	Confirmed	Present	AL
Moorhen (<i>Gallinula chloropus</i>)	Possible	Present	GL
Mute Swan (<i>Cygnus olor</i>)	Probable	Present	AL
Pochard (<i>Aythya ferina</i>)	Present	Present	RL
Raven (<i>Corvus corax</i>)	Probable	-	GL
Red-breasted Merganser (<i>Mergus serrator</i>)	Possible	-	AL
Redwing (<i>Turdus iliacus</i>)	-	Present	RL
Reed Bunting (<i>Emberiza schoeniclus</i>)	Possible	Present	GL
Robin (<i>Erithacus rubecula</i>)	Confirmed	Present	GL
Rock Pigeon (<i>Columba livia</i>)	Present	Present	GL
Rook (<i>Corvus frugilegus</i>)	Confirmed	Present	GL
Sand Martin (<i>Riparia riparia</i>)	Confirmed	-	AL
Sedge Warbler (<i>Acrocephalus schoenobaenus</i>)	Possible	-	GL
Siskin (<i>Carduelis spinus</i>)	Confirmed	Present	GL
Song Thrush (<i>Turdus philomelos</i>)	Possible	Present	GL
Sparrowhawk (<i>Accipiter nisus</i>)	Possible	Present	GL, IV
Spotted Flycatcher (<i>Muscicapa striata</i>)	Possible	-	AL
Starling (<i>Sturnus vulgaris</i>)	Confirmed	Present	AL
Stonechat (<i>Saxicola torquata</i>)	Confirmed	Present	GL
Swift (<i>Apus apus</i>)	Possible	-	RL
Teal (<i>Anas crecca</i>)	Present	Present	AL
Tree Sparrow (<i>Passer montanus</i>)	Present	Present	AL
Treecreeper (<i>Certhia familiaris</i>)	Probable	Present	GL
Tufted Duck (<i>Aythya fuligula</i>)	Probable	Present	AL, SCI
Water Rail (<i>Rallus aquaticus</i>)	Confirmed	Present	GL
White Wagtail (<i>Motacilla alba</i>)	Confirmed	Present	GL
Whitethroat (<i>Sylvia communis</i>)	Possible	-	GL
White-throated Dipper (<i>Cinclus cinclus</i>)	Probable	Present	GL
Whooper Swan (<i>Cygnus cygnus</i>)	-	Present	AL, BD

Species Name	Breeding Atlas (07-11)	Wintering Atlas (07-11)	Conservation Status ¹²
Wigeon (<i>Anas penelope</i>)	Present	Present	AL
Willow Warbler (<i>Phylloscopus trochilus</i>)	Confirmed	-	AL
Winter Wren (<i>Troglodytes troglodytes</i>)	Confirmed	Present	GL
Wood Pigeon (<i>Columba palumbus</i>)	Probable	Present	GL
Woodcock (<i>Scolopax rusticola</i>)	Possible	-	RL

Appendix 3. Target species for the proposed development site.

Target Species	Conservation Status	Typical Habitat ¹³
Black-headed Gull (<i>Larus ridibundus</i>)	I-WeBS/Bird Atlas/ Amber-listed/Wildlife Acts	<p>Breeding Both on the coast and inland where they will often nest in colonies. Usually, nests on the ground in wetland areas, such as bogs and marshes and will also use man made lakes. Numbers breeding inland have declined dramatically, probably due to predation by the American Mink, which is an able swimmer and is able to access previously inaccessible nesting areas. The largest colonies in Ireland are in Northern Ireland on Lough Neagh. Colonies in the Republic are not widespread, the largest are found inland in Counties Galway, Monaghan and Mayo and at coastal sites in Counties Wexford and Donegal.</p> <p>Wintering Irish birds are augmented by wintering birds from northern and eastern Europe and are widespread on both on the coast and inland.</p>
Black-tailed Godwit (<i>Limosa limosa</i>)	NBDC R68/Red-listed/Wildlife Acts	<p>Breeding Breed in lowland wet grassland and marshes. Nine breeding sites were identified in Ireland during the last breeding atlas. More recently, birds were present during the breeding season between 1996 and 1999 inclusive, though breeding was not proven.</p> <p>Wintering Winter visitor from Iceland. Numbers remain high throughout the winter, especially September. Winters in a variety of habitats, both inland (particularly grassland and river deltas) and coastal (particularly estuaries), though seldom seen along non-estuarine coast.</p>
Common Gull (<i>Larus canus</i>)	Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Nests on the ground in a wide variety of situations, including, islands, cliffs and shingle banks. Breeds on the coast and inland in the west of Ireland, from Dingle to Malin Head, with most colonies in Co. Galway, Co. Mayo and Co. Donegal. Inland it can breed on islands in lakes where it has declined. These declines, like those of inland breeding Black-headed Gulls, have been attributed to predation by American Mink, reaching previously safe nesting areas.</p> <p>Wintering Numbers of resident birds are joined by wintering birds from Europe.</p>
Common Sandpiper (<i>Actitis hypoleucos</i>)	NBDC R68 & R78/Amber-listed/Wildlife Acts	<p>Breeding Summer visitor from west Africa, south of the Sahara - breeding birds present March to September. Nests on the ground amongst stones and low vegetation, usually very close to water - often on river or lakeside beach. Inland lakes and sea coast, mainly in northern and western counties.</p> <p>Wintering Small numbers winter in Ireland, mainly along the southern coast. The majority of the Irish and European population winters around the Mediterranean and western Africa</p>
Common Tern (<i>Sterna hirundo</i>)	NBDC R68 & R78/Amber-listed/Wildlife Acts	<p>Breeding Summer visitor from March to October to all Irish coasts. Nest colonially on the ground from August to October. Breeds on the coast, with larger colonies in Co. Dublin, Co. Wexford and Co. Galway. Also breeds inland on islets in freshwater lakes, notably in Co. Galway and in Co. Mayo.</p> <p>Wintering</p>

¹³ birdwatchireland.ie

Target Species	Conservation Status	Typical Habitat ¹³
		Winters in west and south Africa.
Coot (<i>Fulica atra</i>)	I-WeBs/ Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Not as widespread as the Moorhen as it requires larger bodies of water on which to nest. They nest in large shallow water bodies that are rich in nutrients and have abundant bottom vegetation for food and some emergent vegetation for nest anchorage. Widespread but absent from parts of Kerry, Cork, south-west Clare, west Galway, Mayo, Sligo and Donegal.</p> <p>Wintering Distribution is more widespread than breeding distribution, birds are found on lakes, coastal estuaries and river systems, but show a clear preference for large inland lakes.</p>
Common Tern (<i>Sterna hirundo</i>)	Annex I EU Birds Directive/BoCCI Amber-listed/Wildlife Acts/SCI	<p>Breeding Nest colonially on the ground from April to October. Breeds on the coast, with larger colonies in Co. Dublin, Co. Wexford and Co. Galway. Also breeds inland on islets in freshwater lakes, notably in Co. Galway and in Co. Mayo.</p> <p>Wintering Does not winter in Ireland.</p>
Cormorant (<i>Phalacrocorax carbo</i>)	BoCCI Amber-listed/ Wildlife Acts/SCI	<p>Breeding Breeds in colonies mainly around the coast of Ireland, with some birds breeding inland. Birds on the coast breed on cliffs whilst those inland, in trees.</p> <p>Wintering Winters at sea and inland.</p>
Curlew (<i>Numenius arquata</i>)	BoCCI Red-listed/Wildlife Acts	<p>Breeding Nests on the ground in rough pastures, meadows and heather. Not a common breeder but found in most parts of the country.</p> <p>Wintering Winters in a wide range of wetland habitats (coastal and inland) and other good feeding areas including damp fields.</p>
Gadwall (<i>Anas strepera</i>)	Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Nest on a variety of freshwater and brackish wetlands, especially shallow lakes with abundant emergent vegetation, slow moving rivers and marshes.</p> <p>Wintering Localised wintering distribution at a variety of inland and coastal sites. Numbers are increased by migrating birds from Europe.</p>
Golden Plover (<i>Pluvialis apricaria</i>)	Annex I EU Birds Directive/BoCCI Red-listed/Wildlife Acts	<p>Breeding Breed in heather moors, blanket bogs & acidic grasslands. Distribution limited to the uplands of north western counties in Ireland.</p> <p>Wintering Throughout the winter, Golden Plovers are regularly found in large, densely-packed flocks, and in a variety of habitats, both coastal and inland. Their distribution is widespread in Ireland.</p>
Goldeneye (<i>Bucephala clangula</i>)	BoCCI Red-listed /Wildlife Acts/SCI	<p>Breeding Nests in holes in trees and nestboxes, and occasionally in rabbit burrows, usually near water. One pair bred at Lough Neagh in 2000 - the first breeding record in Ireland.</p> <p>Wintering</p>

Target Species	Conservation Status	Typical Habitat ¹³
		Winter on coastal estuaries and inland lakes. Relatively widespread distribution in Ireland.
Great Black-backed Gull (<i>Larus marinus</i>)	Bird Atlas/ BoCCI Green-listed/ Wildlife Acts	<p>Breeding Breeds on the ground in colonies all around the coast of Ireland. Most colonies are on well-vegetated off-shore islands, or in other areas difficult of access, making the species to census. A few birds breed inland where they associate with freshwater lakes in Co. Mayo and Co. Galway.</p> <p>Wintering Resident birds are joined by immigrants in the winter. Found around the coast with some birds inland.</p>
Great Crested Grebe (<i>Podiceps cristatus</i>)	I-WeBS/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Age of first breeding: 2 years. Breed on large, shallow eutrophic loughs, and along canals and slow flowing rivers – wetlands with emergent vegetation bordered by open water are generally selected. Nests are a large mound of aquatic vegetation and are usually well concealed within reeds.</p> <p>Wintering Winter distribution is widespread with greatest concentration in the north midlands and northeast and birds from the continent join the resident population. Outside the breeding season they are often solitary with some birds moving to the coast through the winter. Occasionally, large congregations form for short periods. Birds start returning to breeding areas from mid-February.</p>
Greater White-fronted Goose (<i>Anser albifrons</i>)/ Greenland White-fronted Goose	NBDC R68/Amber-listed/Wildlife Acts	<p>Breeding Breeds on lowland tundra, often by lakes and rivers. Nests are widely scattered, though loose colonies may be formed.</p> <p>Wintering Scarce winter visitor to wetlands in Wexford and western Ireland from October to April. Winters in Ireland and Scotland. Highly gregarious. Traditionally occurred in peatland areas, though now mostly seen feeding on intensively managed grasslands</p>
Greater Scaup (<i>Aythya marila</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Does not breed in Ireland. The breeding range includes Greenland, Iceland, northern Scandinavia and Siberia, as well as North America. Scaup nest beside shallow tundra pools and lakes.</p> <p>Wintering Scaup occur mostly in small parties and occasionally larger flocks around coastal estuaries and bays, on brackish lagoons and in shallow marine waters, usually less than 10 m in depth.</p>
Greenshank (<i>Tringa nebularia</i>)	NBDC R68/Green-listed/Wildlife Acts	<p>Breeding There have been occasional sightings of birds in suitable habitat (BoCCI listing), and one pair was confirmed to have bred in Co. Mayo on at least 2 occasions during the early 1970's (Irish Birds 1: 236-238, 1978). The main breeding range in Europe extends from pool-dominated and boulder-shrewn bogland areas of Scotland to Scots Pine woods in Scandinavia.</p> <p>Wintering Winter visitor to estuaries from September to April from Scotland and Scandinavia. Mostly coastal distribution - while the majority are found on estuaries, up to 30% are estimated to winter along non-estuarine coast.</p>
Grey Heron (<i>Ardea cinerea</i>)	Bird Atlas/ BoCCI Green-listed/ Wildlife Acts	<p>Breeding In large trees and can form large heronries, some of which have been in use for over 100 years.</p>

Target Species	Conservation Status	Typical Habitat ¹³
		Wintering Found in the same wetland habitats during the winter as in the breeding season. Birds breeding in Ireland are thought to be sedentary and birds from Britain and even Scandinavia join our resident population for the winter.
Greylag Goose (<i>Anser anser</i>)	Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	Breeding By lakes and reservoirs, with the nest site often close to water and hidden in reeds or other waterside vegetation. Nests in pairs, but locally colonially. Wintering The Icelandic population winters in Scotland and Ireland, occurring mostly at coastal sites. Highly gregarious.
Grey Wagtail (<i>Motacilla cinerea</i>)	BoCCI Red-listed/ Wildlife Acts	Breeding Breeds mainly along streams and rivers, frequently building its nest under a bridge. Wintering Generally sedentary. Some birds move to coastal areas, especially those where large amounts of seaweed have washed up.
Hen Harrier (<i>Circus cyaneus</i>)	Annex I EU Birds Directive/BoCCI Amber-listed/Wildlife Acts/SCI	Breeding Breeding birds are confined largely to heather moorland and young forestry plantations, where they nest on the ground. Wintering Spends winter in more coastal and lowland areas throughout Ireland hence most easily seen on the coast in the winter months.
Herring Gull (<i>Larus argentatus</i>)	Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	Breeding In colonies around the coast of Ireland and also inland in Co. Donegal and Co. Galway. The biggest colony in Ireland is on Lambay island off Co. Dublin with over 1,800 nests. Wintering Widespread on the coast and inland.
Kestrel (<i>Falco tinnunculus</i>)	BoCCI Red-listed/Wildlife Acts	Breeding A widespread breeder throughout the country. Nests in trees, buildings or in cracks in cliffs. Will use old crows nests. Found in wide variety of open habitats including coasts, moor land, farmland, wetlands, roadside verges and town parks. Wintering Largely resident within breeding territory. Some birds move within the country, especially down from the uplands.
Kingfisher (<i>Alcedo atthis</i>)	Annex I EU Birds Directive/BoCCI Amber-listed/ Wildlife Acts	Breeding Kingfishers breed in tunnels dug in vertical banks along streams and rivers Wintering A very sedentary species, Kingfishers rarely move from their territories. However, some may move to lakes and coasts during extended spells of poor weather
Lapwing (<i>Vanellus vanellus</i>)	BoCCI Red-listed/ Wildlife Acts	Breeding They breed on open farmland, and appear to prefer nesting in fields that are relatively bare (particularly when cultivated in the spring) and adjacent to grass. Wintering

Target Species	Conservation Status	Typical Habitat ¹³
		Wintering distribution in Ireland is widespread. Large flocks regularly recorded in a variety of habitats, including most of the major wetlands, pasture and rough land adjacent to bogs.
Lesser Black-backed Gull (<i>Larus fuscus</i>)	NBDC R68/Amber-listed/Wildlife Acts	<p>Breeding Summer visitor to lakes and coasts from March to September, wintering in Iberia and northwest Africa. Winter visitor in small numbers along eastern and southern coasts, probably from Iceland and the Faeroe Islands. Breeds colonially, often with other gull species especially Herring Gull. Nests on the ground. Will use a variety of sites, including off shore islands, islands in inland lakes, sand dunes and coastal cliffs. Small numbers also nest on roof tops in Co. Dublin. Most colonies in Ireland are on the coast, mostly on the west coast. Most inland colonies are found in Co. Mayo and in Co. Donegal.</p> <p>Wintering In the winter, the species is found in a wide variety of habitats both inland and along the south and east coasts. The largest numbers occur after the breeding season in autumn when migrating birds pass through Ireland in great numbers.</p>
Little Egret (<i>Egretta garzetta</i>)	Annex I EU Birds Directive/BoCCI Green-listed/Wildlife Acts	<p>Breeding Breeds in lakes, marshes, flooded fields & estuaries.</p> <p>Wintering Little Egrets use a variety of wetland habitats, including shallow lakes, riverbanks, lagoons, coastal estuaries and rocky shoreline.</p>
Mallard (<i>Anas platyrhynchos</i>)	I-WeBS/ Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Nest sites vary, mostly in ground where hidden in vegetation.</p> <p>Wintering Mallard are the most widespread species, although not quite as numerous as Wigeon or Teal. They occur in almost all available wetland habitats in Ireland.</p>
Moorhen (<i>Gallinula chloropus</i>)	Bird Atlas/ BoCCI Green-listed/ Wildlife Acts	<p>Breeding The most common of our river birds. Nests near water, usually in emergent vegetation or on a floating raft. It is widespread throughout the country, only in parts of the west is it absent or rare. Can be found on any freshwater habitat with abundant emergent vegetation, including town canals, muddy ditches, and large lakes.</p> <p>Wintering Close to its breeding areas. Birds breeding on upland areas may move down to lower areas in the winter. Irish birds are joined by migrants from colder climates.</p>
Mute Swan (<i>Cygnus olor</i>)	BoCCI Amber-listed/ Wildlife Acts/SCI	<p>Breeding Breeds on lakes, ponds & rivers, and nests are a large mound constructed from reed stem and other aquatic vegetation, with seaweed being used in coastal locations.</p> <p>Wintering Widespread on lakes, ponds and rivers.</p>
Meadow Pipit (<i>Anthus pratensis</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Very widespread breeding species in Ireland, with around 500,000 to 1,000,000 pairs. Found in bogs, uplands and areas of scrub and pasture.</p> <p>Wintering Generally sedentary, but moves to lowland areas from breeding sites in uplands. Significant numbers of European birds move to Ireland in winter.</p>

Target Species	Conservation Status	Typical Habitat ¹³
Oystercatcher (<i>Haematopus ostralegus</i>)	NBDC R78/Red-listed/Wildlife Acts	<p>Breeding Nests principally on shingle beaches, dunes, salt marshes and rocky shores around the coast, but also on some large inland lakes.</p> <p>Wintering Resident & winter visitor (from Iceland and the Faeroes) - largest numbers in Ireland between September & March. Use all coastal habitats, and particularly favour open sandy coasts. Around 60,000 Oystercatchers spend the winter around the Irish coast, which is a decline of around 28% since the early 2000's.</p>
Pink-footed Goose (<i>Anser brachyrhynchus</i>)	NBDC R68/Green-listed/Wildlife Acts	<p>Breeding Breeds on the open tundra of Greenland, Iceland and Svalbard from May to August.</p> <p>Breeding A scarce winter visitor from October to March usually associating with other geese. On the coastal marshes of the UK, as well as Belgium and Denmark. It is only a scarce visitor to Ireland associating with other wintering geese such as Greylag and White-fronts.</p>
Pochard (<i>Aythya ferina</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Nests on the ground among waterside vegetation.</p> <p>Wintering Show a preference for large shallow eutrophic waters, particularly those with well-vegetated marshes and swamps and slow flowing rivers.</p>
Red-breasted Merganser (<i>Mergus serrator</i>)	Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Nest on sheltered lakes and large rivers throughout the west and north of the country, though they are largely absent from Clare and a few pairs have been recorded in Wexford. They use a variety of nesting habitats, usually located beside fast-flowing rivers, large and small lakes, also along the coast, on islands and sea-loughs</p> <p>Wintering Winter exclusively in brackish and marine waters, particularly in shallow protected estuaries and bays and lagoons, and also offshore.</p>
Redwing (<i>Turdus iliacus</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Does not breed in Ireland.</p> <p>Wintering Common winter visitor to Ireland with birds from the Icelandic and Scandinavian breeding populations arriving in October and departing again between mid-March and early-April. Favours open fields in lowland areas, but tends to avoid urban areas.</p>
Redshank	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Nests on the ground in grassy tussock, in wet, marshy areas and occasionally heather. Adults often keep guard standing on fence posts or high rocks. Breeds mainly in midlands (especially Shannon Callows) and northern half of the country, but not commonly anywhere in Ireland.</p> <p>Wintering Winters all around the coasts of Ireland, Britain and many European countries. Favours mudflats, large estuaries and inlets. Smaller numbers at inland lakes and large rivers.</p>
Shelduck (<i>Tadorna tadorna</i>)	NBDC R68/Amber-listed/Wildlife Acts	<p>Breeding Breeds in open areas along seashores, larger lakes and rivers. Nest in holes in banks, trees, occasionally strawstacks or buildings. There has been a recent expansion in the range of the northwest European</p>

Target Species	Conservation Status	Typical Habitat ¹³
		<p>population, and birds in Ireland and Britain have been displaced from coastal breeding sites and are increasingly using inland sites.</p> <p>Wintering Resident and winter migrant - Ireland receives additional birds during the winter (October to March) from Scandinavia and the Baltic. Sheltered estuaries or tidal mudflats.</p>
Shoveler	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Nests on the ground among waterside vegetation, often many nests in close proximity. Breeding in Ireland is centred around Lough Neagh and the mid- Shannon basin.</p> <p>Wintering Shoveler prefer shallow eutrophic waters rich in plankton, and occur on a variety of habitats while wintering in Ireland, including coastal estuaries, lagoons and inland lakes and callows.</p>
Snipe (<i>Gallinago gallinago</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Nests on the ground, usually concealed in a grassy tussock, in or near wet or boggy terrain.</p> <p>Wintering Highly dispersed distribution in winter. They forage across a variety of wetland and damp habitats. Particularly high concentrations are found on the fringes of lowland lakes.</p>
Sparrowhawk (<i>Accipiter nisus</i>)	BoCCI Amber-listed/ Wildlife Acts	<p>Breeding Probably the most common bird of prey in Ireland. Widespread in woodland, farmland with woods, larger parks and gardens.</p> <p>Wintering Resident in Ireland. Can be seen throughout the country.</p>
Spotted Crake (<i>Porzana porzana</i>)	NBDC R78/Amber-listed/Wildlife Acts	<p>Breeding Summer visitors to marshes around lakes and rivers with low water level.</p> <p>Wintering Spotted Crakes winter in Africa.</p>
Swift (<i>Apus apus</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Breeds throughout Ireland, usually in small recesses in buildings, both occupied and derelict. Less frequently in holes in trees or caves in uplands or coastal areas.</p> <p>Wintering Does not winter in Ireland.</p>
Teal (<i>Anas crecca</i>)	Bird Atlas/ BoCCI Amber-listed/ Wildlife Acts	<p>Breeding They usually nest near small freshwater lakes or pools and small upland streams away from the coast, and also in thick cover.</p> <p>Wintering Widespread on wetlands with good cover, such as reedbeds. Wide variety of habitats, both coastal and inland, and usually below an altitude of 200 m, including coastal lagoons and estuaries and inland marshes, lakes, ponds and turloughs.</p>
Tufted Duck (<i>Aythya fuligula</i>)	BoCCI Amber-listed/ Wildlife Acts/SCI	<p>Breeding Show a preference for large open lakes in lowland areas, where nests are built in waterside vegetation. Many nests in close proximity to each other.</p> <p>Wintering</p>

Target Species	Conservation Status	Typical Habitat ¹³
		Lowland freshwater lakes. Often seen on town lakes, canals and slow-moving rivers.
White-tailed Eagle (<i>Haliaeetus albicilla</i>)	Annex I EU Birds Directive/BoCCI Red-listed/Wildlife Acts	<p>Breeding Mixed success in terms of breeding in Ireland since the recent reintroduction at Mountshannon and Portumna. Historically a widespread breeding species, and formerly the last wild pair bred in County Mayo in 1912. This is reflected in the prevalence of place names in western Ireland referencing "eagles".</p> <p>Wintering Resident. Young birds move to new territories after fledging.</p>
White-winged Tern (<i>Chlidonias leucopterus</i>)	NBDC (1992) R68 & R78 /Wildlife Acts	<p>Rare vagrant. Global Distribution: A widespread summer visitor to eastern Europe, which accounts for less than a quarter of its global breeding range. Also found in Asia, Australia and New Zealand. (Birdlife International)</p>
Whooper Swan (<i>Cygnus cygnus</i>)	Annex I EU Birds Directive/BoCCI Amber-listed/Wildlife Acts	<p>Breeding The Whooper Swans that are present in Ireland each winter nest in Iceland during the summer. Each year a small number of Whoopers stay in Ireland for the summer and there have been occasional breeding records on lakes in the midlands and north west.</p> <p>Wintering Most on lowland open farmland around inland wetlands, regularly seen while feeding on grasslands and stubble.</p>
Wigeon (<i>Anas penelope</i>)	BoCCI Amber-listed/ Wildlife Acts	<p>Wintering Coastal marshes, freshwater and brackish lagoons, estuaries, bays. Many on inland wetlands, lakes, rivers and turloughs.</p>
Woodcock (<i>Scolopax rusticola</i>)	BoCCI Red-listed/ Wildlife Acts	<p>Breeding Nests on the ground in forests and woodland, usually well camouflaged amongst dead leaves and low vegetation.</p> <p>Wintering Wider distribution in winter, occurring in woodland, also scrub and some open areas (bracken and heather-covered hills).</p>

Appendix 4. Winter season and Summer season survey results for wetland and waterbirds

Location	Winter												Summer											
Season	Mainland						Inis Cealtra						Mainland						Inis Cealtra					
Species	Oct	Nov	Dec	Jan	Feb	Mar	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Apr	May	Jun	Jul	Aug	Sep
Arctic Tern																				✓				
Black-headed Gull	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Common Gull								✓			✓	✓				✓							✓	
Common Tern														✓						✓	✓	✓		
Coot	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓			✓	✓	✓		✓
Cormorant	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓
Curlew								✓			✓	✓											✓	✓
Golden Plover								✓				✓												
Goldeneye			✓	✓	✓			✓	✓															
Great Black-backed Gull				✓				✓			✓						✓				✓	✓	✓	
Great Crested Grebe	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓
Grey Heron		✓	✓			✓	✓	✓	✓			✓		✓	✓		✓				✓	✓		✓
Grey Wagtail							✓		✓	✓												✓		
Greylag Goose		✓	✓			✓			✓			✓		✓								✓	✓	✓
Herring Gull				✓	✓			✓																
Jack Snipe											✓													
Kingfisher						✓														✓			✓	
Lapwing	✓		✓	✓	✓																			

Location	Winter												Summer											
Season	Mainland						Inis Cealtra						Mainland						Inis Cealtra					
Species	Oct	Nov	Dec	Jan	Feb	Mar	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Apr	May	Jun	Jul	Aug	Sep
Lesser Black-backed Gull		✓			✓			✓				✓										✓	✓	
Little Egret		✓	✓					✓									✓	✓				✓	✓	
Little Grebe	✓	✓	✓	✓		✓	✓	✓		✓		✓								✓	✓	✓	✓	✓
Mallard			✓	✓				✓	✓		✓	✓								✓	✓	✓	✓	✓
Moorhen			✓			✓		✓	✓	✓		✓								✓	✓	✓	✓	✓
Mute Swan		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Pintail										✓														
Pochard					✓																			
Red-breasted Merganser												✓												
Redshank								✓																
Shoveler														✓										
Snipe								✓		✓		✓								✓				✓
Teal			✓					✓		✓													✓	
Tufted Duck	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓												✓
Whimbrel																				✓				
Whooper Swan		✓	✓	✓	✓	✓				✓														
Wigeon			✓								✓													

Appendix 5. Winter season and Summer season survey results for non-wetland and non-waterbirds.

Location	Winter												Summer											
Season	Mainland						Inis Cealtra						Mainland						Inis Cealtra					
Species	Oct	Nov	Dec	Jan	Feb	Mar	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Apr	May	Jun	Jul	Aug	Sep
Buzzard						✓				✓						✓								
Hen harrier								✓																
Kestrel	✓																							
Meadow Pipit							✓	✓	✓	✓		✓								✓				✓
Redwing							✓	✓	✓	✓	✓	✓												
Sparrowhawk							✓																✓	
Swift																					✓	✓		
White-tailed eagle		✓		✓					✓		✓	✓						✓						✓

Appendix 6. Secondary Species

The following secondary species were recorded at the proposed development site during ornithological surveys conducted between March 2021 and March 2023 inclusive. In the following sub-sections, observations of secondary species are summarised as per surveys undertaken.

While secondary species may not meet the criteria for a target species, all birds are protected under the Wildlife Acts 1976 – 2021.

Transect of Inis Cealtra

Transect Results 2021

During the transect surveys, 34 secondary bird species were recorded in 2021. Records are summarised below in **Table 35**.

Table 35: Transect 2021 survey results for secondary species.

Common Name	Mar	May	Jun	Nov	Dec
Passerine and near passerine birds					
Blackbird	8	15	8	10	12
Blackcap	0	10	8	0	0
Blue Tit	4	2	2	2	0
Bullfinch	2	0	2	7	6
Chaffinch	6	8	5	20	10
Coal Tit	0	0	0	1	0
Cuckoo	0	0	0	1	0
Dunnock	4	8	6	10	7
Fieldfare	0	0	0	1	0
Goldcrest	1	1	0	1	1
Goldfinch	4	9	6	1	0
Great Tit	2	0	0	0	4
Hooded Crow	2	2	2	1	2
House Martin	0	0	1	0	0
Lesser Redpoll	0	0	2	2	2
Linnet	0	0	0	3	2
Long-tailed Tit	0	1	0	5	10
Magpie	0	2	0	1	0
Pheasant	0	3	1	0	1
Pied Wagtail	2	2	1	0	0
Raven	2	6	0	0	0
Reed Bunting	6	7	0	3	1
Robin	7	6	12	5	5
Sand Martin	0	2	0	0	0
Sedge Warbler	0	6	7	0	0

Common Name	Mar	May	Jun	Nov	Dec
Song Thrush	0	8	6	5	5
Starling	2	4	3	0	0
Swallow	0	2	4	0	0
Treecreeper	1	0	0	0	0
Whitethroat	0	0	1	0	0
Willow Warbler	0	4	3	0	0
Woodpigeon	4	4	6	2	11
Wren	4	7	8	10	8

Transect Results 2022

During the transect surveys, 39 secondary bird species were recorded in 2022. Records are summarised below in **Table 36**.

Table 36: Transect 2022 survey results for secondary species.

Common Name	Jan	Mar	May	June	July	Aug	Sept	Oct	Nov	Dec
Passerine and near passerine birds										
Blackbird	7	8	10	4	4	0	4	7	8	6
Blackcap	0	0	7	8	4	12	0	0	0	0
Blue Tit	2	2	2	5	4	6	3	7	4	3
Bullfinch	4	2	0	3	6	5	1	9	11	10
Chaffinch	10	12	4	0	3	10	8	17	13	5
Coal Tit	2	0	0	0	0	0	0	0	0	0
Dunnock	4	6	4	0	3	2	3	4	2	3
Fieldfare	0	0	0	0	0	0	0	6	0	0
Goldcrest	0	1	5	0	1	1	3	5	2	2
Goldfinch	0	5	0	9	7	4	3	3	2	3
Great Tit	0	0	0	3	2	0	1	4	0	1
Greenfinch	0	0	0	0	0	0	0	5	4	1
Hooded Crow	4	0	2	2	0	0	2	1	2	1
House Martin	0	0	2	0	6	2	10	0	0	0
Lesser Redpoll	0	4	0	0	2	2	0	3	0	1
Linnet	2	0	0	0	0	0	0	8	51	4
Long-tailed Tit	2	0	5	0	0	0	6	1	0	0
Mistle Thrush	0	0	0	0	0	0	0	3	0	0
Pheasant	0	0	1	6	0	0	2	1	3	0
Pied Wagtail	3	0	0	0	0	0	1	1	2	2
Raven	2	2	1	0	0	0	1	0	0	1
Reed Bunting	3	9	8	9	8	6	1	6	0	1
Robin	6	10	10	4	5	12	10	19	11	5
Rook	0	0	0	0	5	0	0	1	0	0
Sand Martin	0	0	0	0	6	1	9	0	0	0
Sedge Warbler	0	0	1	8	6	0	0	0	0	0
Song Thrush	4	0	3	3	2	1	2	5	5	8
Starling	0	6	6	0	0	6	16	0	0	0
Stonechat	2	2	0	0	2	0	0	1	1	2
Swallow	0	0	2	2	14	2	38	0	0	0
Treecreeper	1	0	0	0	1	0	0	1	0	1
Willow Warbler	0	0	3	5	2	2	0	0	0	0
Woodpigeon	6	4	4	12	2	7	1	16	4	5
Wren	5	10	12	10	7	12	9	14	15	8

Transect Results 2023

During the transect surveys, 40 secondary bird species were recorded in 2023. Records are summarised below in **Table 37**.

Table 37: Transect 2023 survey results for secondary species.

Common Name	Jan	Feb	Mar	May	Jun	July	Aug	Sep
Passerine and near passerine birds								
Blackbird	10	5	8	7	4	6	4	6
Blackcap	0	0	0	3	3	2	0	0
Blue tit	2	3	3	5	2	6	2	5
Bullfinch	5	5	7	0	2	3	3	2
Chaffinch	9	11	0	14	3	5	12	6
Coal Tit	1	0	0	1	0	0	0	0
Dunnock	7	2	4	2	1	1	0	2
Goldcrest	2	1	4	1	4	2	1	3
Goldfinch	3	4	0	13	5	7	8	9
Dunnock	7	2	4	2	1	1	0	2
Great tit	1	1	6	1	1	2	2	1
Greenfinch	0	1	0	0	0	2	0	0
Hooded Crow	3	0	0	0	1	1	0	0
House Martin	0	0	0	0	1	0	0	0
House Sparrow	0	0	0	0	0	0	1	1
Lesser Redpoll	0	0	1	1	2	0	0	0
Linnet	8	4	0	2	0	0	0	1
Long-tailed tit	0	0	4	0	2	1	7	1
Magpie	0	0	0	0	0	1	0	0
Mistle Thrush	1	2	0	0	0	0	0	0
Pheasant	1	1	1	0	0	10	7	3
Pied Wagtail	1	0	1	2	1	0	1	1
Raven	0	0	1	4	0	0	0	0
Reed Bunting	1	2	0	17	16	14	0	0
Robin	12	9	5	5	6	2	12	9
Rook	0	0	2	0	0	0	0	0
Sedge Warbler	0	0	0	19	23	6	0	0
Skylark	0	0	1	1	0	0	0	0
Song Thrush	9	5	0	2	0	0	1	2

Common Name	Jan	Feb	Mar	May	Jun	July	Aug	Sep
Spotted flycatcher	0	0	0	0	0	3	2	1
Starling	0	0	0	0	0	0	50	100
Stonechat	0	0	0	1	1	0	0	0
Swallow	0	0	0	6	5	7	8	9
Treecreeper	0	0	3	2	5	5	1	0
Willow Warbler	0	0	0	4	2	5	0	0
Woodpigeon	5	24	8	3	3	2	0	0
Wren	10	9	6	13	6	9	14	5

Transect Results 2024

During the transect surveys, 24 secondary bird species were recorded in 2024. Records are summarised below in **Table 38**.

Table 38: Transect 2024 survey results for secondary species.

Common Name	Jan	Feb	Mar
Passerine and near passerine birds			
Blackbird	6	16	16
Blackcap	0	0	1
Blue Tit	6	3	6
Bullfinch	2	4	4
Chaffinch	8	8	13
Dunnock	2	2	3
Goldcrest	1	0	3
Goldfinch	3	0	2
Great Tit	0	1	1
Long-tailed Tit	4	0	0
Mistle Thrush	0	0	1
Pheasant	6	0	2
Pied Wagtail	3	6	1
Raven	0	0	2
Reed Bunting	0	0	6
Robin	4	8	13
Rook	0	0	1
Siskin	0	0	1
Song Thrush	4	2	7
Starling	1	1	1
Treecreeper	0	0	2
Woodpigeon	6	5	6
Wren	6	7	15

Shore Count Results 2023

During the shore count surveys, two secondary bird species were observed in 2023. Observations are summarised below in **Table 39**.

Table 39: Shorebird 2023 count survey results for secondary species.

Common Name	Notes	Jul	Aug
House Martin	-	1	0
Pied Wagtail	-	1	1

Appendix 7. Survey information

Survey	Date	Observer	Start Time	Finish Time	Weather
Transect	16/03/2021	JM	10:30	15:30	A fine dry sunny day. South to south westerly wind F4-5. Temp 10°C with good visibility.
Transect	05/05/2021	JM	10:30	15:30	A dry sunny day with a cool northerly breeze Temperature 15°C with good visibility.
Transect	10/06/2021	CBH	10:30	15:30	A mainly dry day with some light showers in the afternoon. SW wind F3-5. Temperature 18°C with good visibility.
Transect	25/11/2021	JM	11:00	13:00	A dry sunny day with F1-4 wind Temperature 15°C with good visibility.
Informal	25/11/2021	JM	Not recorded	Not recorded	A dry sunny day with F1-4 wind Temperature 15°C with good visibility.
Transect	15/12/2021	JM	8:30	12:30	A dry warm sunny day. Temperature 8 - 10°C with good visibility.
Informal	15/12/2021	JM	Not recorded	Not recorded	A dry warm sunny day. Temperature 8 - 10°C with good visibility.
Transect	31/01/2022	JM	11:00	17:00	A mostly dry day with some showers. Temperature 8 - 10°C with good visibility.

Survey	Date	Observer	Start Time	Finish Time	Weather
Mountshannon	31/01/2022	JM	Not recorded	Not recorded	A mostly dry day with some showers. Temperature 8 - 10°C with good visibility.
Transect	01/03/2022	NL	10:30	12:30	A dry sunny day with some light showers in the afternoon. SW Wind F3-5. Temperature 8°C with good visibility.
Transect	19/05/2022	JM	11:00	14:00	A dry sunny day with very strong SW winds F5-6. Temperature 16-18°C with good visibility.
Transect	14/06/2022	JM	11:30	13:30	A mostly dry warm day with full cloud cover and some sunshine. Temperature 15-17°C with good visibility.
Transect	12/07/2022	JM	11:00	14:00	A cool W F3-4 wind with damp misty rain and full cloud cover. Temperature 16°C with good visibility.
Transect	31/08/2022	PC	10:30	13:30	A dry sunny day. Temperature: 16-18°C. Visibility: Good
Transect	27/09/2022	PC	11:00	14:00	Wind: SW, F2. Rain: 1.5mm, Cloud cover 8/8. Temperature 11°C. Visibility poor

Survey	Date	Observer	Start Time	Finish Time	Weather
Transect	25/10/2022	PC	11:00	13:00	Rain: Mostly dry with some rain (0.1mm). Wind: SW, F3-4. Cloud cover 6/8. Temperature 17°C. Visibility: good
Shorebird Count	25/10/2022	PC	09:00	10:00	Rain: Mostly dry with some rain (0.1mm). Wind: SW, F3-4. Cloud cover 6/8. Temperature 17°C Visibility: good
Transect	24/11/2022	PC	11:00	13:15	Rain: Dry with odd showers (0.1mm). Cloud cover 6/8. Visibility: good. Temperature: 9°C
Shorebird Count	24/11/2022	PC	9:00	11:00	Rain: Dry with odd showers (0.1mm). Wind: SW, F4-5. Cloud cover 5/8. Visibility: good. Temperature: 8°C
Transect	08/12/2022	PC	11:00	12:30	Rain: Dry with some rain (0.1mm). Wind: S, F1-2. Cloud cover 6/8. Temperature 5-6°C. Visibility: Good
Shorebird Count	08/12/2022	PC	9:30	11:00	Rain: Dry with fog. Wind: S, F1-2. Cloud cover 7/8. Visibility: good
Transect	19/01/2023	PC	11:00	13:00	Dry, no rain. Wind: NW, 1-Light Air. Cloud cover: 0-33. Visibility: Good.

Survey	Date	Observer	Start Time	Finish Time	Weather
					Temperature: 0°C.
Shorebird count	19/01/2023	PC	09:00	11:00	Dry, no rain. Wind: NW, 1- Light Air. Cloud cover: 0-33. Visibility: Good. Temperature: 0°C.
Transect	08/02/2023	OV	11:00	13:00	Dry, no rain. Wind: SW, moderate Breeze. Cloud cover: 0-33. Visibility: Good. Temperature: 6°C.
Shorebird count	08/02/2023	OV	09:00	11:00	Dry, no rain. Wind: SW, 5- fresh breeze. Cloud cover: 0- 33. Visibility: Good. Temperature: 6°C.
Transect	22/03/2023	OV	11:15	14:00	Showers. Wind: NE, F4. Cloud cover: 6/8. Visibility: Poor. Temperature: 9°C.
Shorebird count	22/03/2023	OV	14:30	17:00	Showers. Wind: SW, F4 breeze. Cloud cover: 8/8. Visibility: Poor. Temperature: 7°C.
Transect	31/05/2023	OV	11:00	13:00	Dry. Wind: SW, 1-Light Air. Cloud cover: 0- 33. Visibility: Good. Temperature: 20°C.
Shorebird Count	31/05/2023	OV	14:00	14:30	Dry. Wind: SW, 1-Light Air. Cloud cover: 0- 34. Visibility:

Survey	Date	Observer	Start Time	Finish Time	Weather
					Good. Temperature: 20°C.
Shorebird Count	31/05/2023	OV	15:00	15:30	Dry. Wind: SW, 1-Light Air. Cloud cover: 0- 35. Visibility: Good. Temperature: 20°C.
Transect	28/06/2023	OV	11:00	13:00	Dry. Wind: SE, 1-Light Air. Cloud cover: 0- 33. Visibility: Good. Temperature: 16°C.
Shorebird Count	28/06/2023	OV	14:00	14:30	Dry. Wind: SE, 1-Light Air. Cloud cover: 0- 33. Visibility: Good. Temperature: 16°C.
Shorebird Count	28/06/2023	OV	15:00	15:30	Dry. Wind: SE, 1-Light Air. Cloud cover: 0- 33. Visibility: Good. Temperature: 16°C.
Transect	20/07/2023	OV	11:00	13:00	Mostly dry with light showers. Wind: SE, 2- Light breeze. Cloud cover: 66-100. Visibility: moderate. Temperature: 16°C.
Shorebird Count	20/07/2023	OV	14:00	14:30	Mostly dry with light showers. Wind: SE, 2- Light breeze. Cloud cover: 66-100. Visibility: moderate. Temperature: 16°C.

Survey	Date	Observer	Start Time	Finish Time	Weather
Shorebird Count	20/07/2023	OV	15:00	15:30	Mostly dry with light showers. Wind: SE, 2-Light breeze. Cloud cover: 66-100. Visibility: moderate. Temperature: 18°C.
Transect	30/08/2023	OV	11:00	13:00	Dry. Wind: SE, 1-Light Air. Cloud cover: 33-66. Visibility: Good. Temperature: 18°C.
Shorebird Count	30/08/2023	OV	14:00	14:30	Dry. Wind: SE, 1-Light Air. Cloud cover: 33-66. Visibility: Good. Temperature: 18°C.
Shorebird Count	30/08/2023	OV	15:00	15:30	Dry. Wind: SE, 1-Light Air. Cloud cover: 33-66. Visibility: Good. Temperature: 16°C.
Transect	29/09/2023	OV	11:00	13:00	Dry. Wind: E, 2-Light Breeze. Cloud cover: 33-66. Visibility: Good. Temperature: 15°C.
Shorebird Count	29/09/2023	OV	14:00	14:30	Dry. Wind: E, 2-Light Breeze. Cloud cover: 33-66. Visibility: Good. Temperature: 15°C.
Shorebird Count	29/09/2023	OV	15:00	15:30	Dry. Wind: E, 2-Light Breeze. Cloud cover: 33-66. Visibility: Good. Temperature: 15°C.

Survey	Date	Observer	Start Time	Finish Time	Weather
Transect	09/01/2023	OV	11:00	13:00	Rain: drizzle. Wind: W, moderate breeze. Cloud cover: 33-66. Visibility: Good. Temperature: 3°C.
Shorebird Count	09/01/2024	OV	14:00	14:30	Rain: drizzle. Wind: W, moderate breeze. Cloud cover: 33-66. Visibility: Good. Temperature: 3°C.
Shorebird Count	09/01/2024	OV	15:00	15:30	Rain: drizzle. Wind: W, moderate breeze. Cloud cover: 33-66. Visibility: Good. Temperature: 3°C.
Transect	21/02/2024	OV	11:00	13:00	Mostly dry with light showers. Wind: NE, 6- Strong breeze. Cloud cover: 33-66. Visibility: moderate. Temperature: 11°C.
Shorebird Count	21/02/2024	OV	14:00	14:30	Dry. Wind: NE, 6-Strong breeze. Cloud cover: 33-66. Visibility: moderate. Temperature: 11°C.
Shorebird Count	21/02/2024	OV	13:15	13:45	Dry. Wind: NE, 6-Strong breeze. Cloud cover: 33-66. Visibility: moderate. Temperature: 11°C.

Survey	Date	Observer	Start Time	Finish Time	Weather
Transect	19/03/2024	OV	11:00	13:00	Dry. Wind: 2-light breeze. Cloud cover: 66-100. Visibility: moderate. Temperature: 9°C.
Shorebird Count	19/03/2024	OV	14:00	14:30	Dry. Wind: 2-light breeze. Cloud cover: 66-100. Visibility: moderate. Temperature: 9°C.
Shorebird Count	19/03/2024	OV	13:15	13:45	Dry. Wind: 2-light breeze. Cloud cover: 66-100. Visibility: moderate. Temperature: 9°C.

APPENDIX 10.2

AQUATIC ECOLOGY SURVEY FOR INIS CEALTRA



VOLUME III

APPENDICES TO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

MWP

AQUATIC ECOLOGY SURVEY

Inis Cealtra

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Appendices

Appendix 1 – Biosecurity Measures

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
21760	6013	1	30 June 2021	GH	XX	XX	FINAL

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1. Introduction

Malachy Walsh and Partners have been commissioned by Clare County Council to prepare a Natura Impact Statement (NIS) in relation to a proposed development at Inis Cealtra (Holy Island) on Lough Derg, Co. Clare. In order to complete the NIS, certain information on the existing environment is required. This report has been prepared to document the findings of a field survey of the aquatic flora and fauna along the shore of the lake. Desk based findings area also presented in Section 4.

Lough Derg is 33 m above sea level, has a maximum depth of 37 m and average depth of 7.5 m. It has a volume of 0.88 km³ and surface area of 188 km². Shallow bays with small rivers and streams lie on either side of a central axis that passes over a series of deeper water depressions of 30+ m from half-way along its length (Bowman, 1999). Lough Derg, the lowest order lake on the River Shannon, is one of the largest bodies of freshwater in Ireland. The Lough is fed primarily by the River Shannon at its northern end near Portumna, which exits the lake at its southern end, and meets the sea in the Shannon estuary southwest of Limerick City. Lough Derg is also fed by several other key tributaries around its shores, including the Nenagh, Woodford, Ballyfinboy, Scariff and Crow Rivers (See **Figure 1**). The margins of Lough Derg are shallow, allowing opportunities for plant colonisation (including several invasive aquatic species). Water quality on Lough Derg (EPA lake number 175) was assessed a total of 12 times between 2001 and 2003 and was rated as 'Mesotrophic' (Toner et al., 2005).

The shoreline is predominantly lined by reed and rush beds beside small settlements, pastures and woods. Lough Derg northeast shore SAC (002241) includes the northern shore of the lake from the mouth of the Cappagh River in the north-west to just below Black Lough at the north-eastern shore. The greater part of this site lies on Carboniferous limestone, although there is Old Red Sandstone on the southern shores of the eastern section. The entire lake is designated as the Lough Derg (Shannon) SPA.

There are no permanent surface water features on Inis Cealtra, with the exception of a well situated near the eastern shore. This is an artificial feature associated with exposure of groundwater.

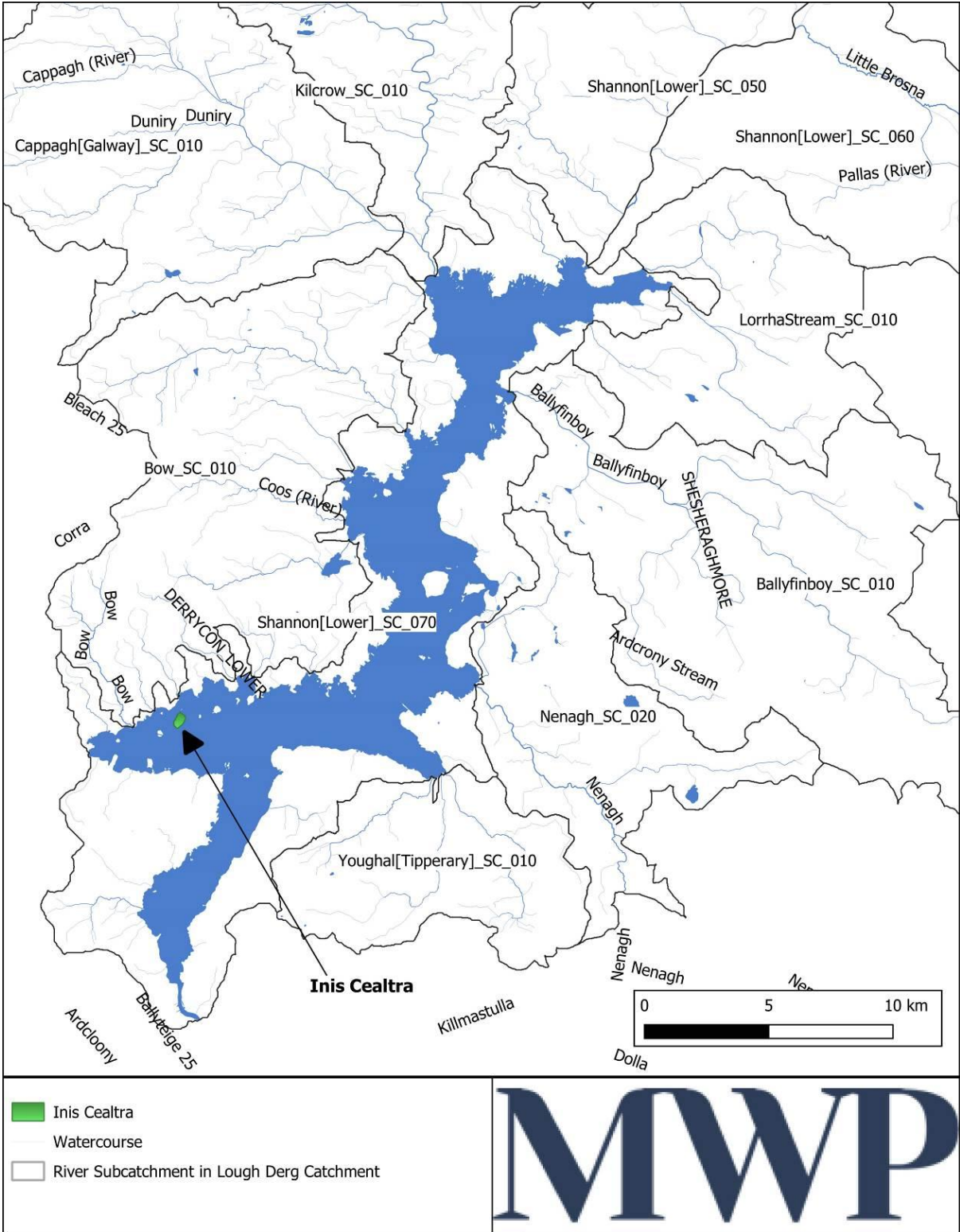


Figure 1 Inis Cealtra, Lough Derg and its afferent watercourses

1.1 Legislative Context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act 1976, as amended, and the orders and regulations made thereunder, such as the Flora Protection Order (2015). The Habitats Directive 1992 has been transposed into Irish law, for the purposes of this application for permission by Part XAB of the Planning and Development Act 2000. In addition, certain other obligations of the Habitat Directive have been transposed by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish. It will be necessary to get written permission from Inland Fisheries Ireland to proceed with the works in any areas where disturbance to the spawning and nursery areas of both salmonids and lampreys will occur as a result of the proposed grid connection route. Salmon, all lamprey species and their habitats are further protected under the EU Habitats Directive, 1992.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in the river would constitute an offence.

1.2 Statement of Authority

Surveying and report compilation was completed by Gerard Hayes of Malachy Walsh and Partners. TGerard Hayes (BSc.) is a Senior Aquatic Ecologist with over 14yrs experience in environmental consultancy. He is a member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and the Freshwater Biological Association (FBA). Gerard has a diverse ecological profile, with aquatic fauna, phase 1 habitat, mammal (including bats), bird, amphibian, macroinvertebrate, and tree survey experience. He has had numerous responsibilities including report writing (EIS, EIA, EA, AA, NIS), waste assimilation capacity assessment, and ecological monitoring. His project involvement has been primarily in the areas of wind energy development, waste-water treatment plants, roads/bridges, water supply, flood defense and hydro schemes. He is co-author and/or carried out surveys for NPWS Irish Wildlife Manual Nos. 15, 24, 26, 37, 45. In 2020, he carried out biological monitoring of rivers for the Environmental Protection Agency in Hydrometric Areas 23 and 24.

2. Methodology

Desk-based results were obtained from a review of publicly available literature and online sources. Maps were generated using a GIS platform and publicly available GIS data. Survey methods are outlined below.

2.1 Habitat Survey

The entire lake shore around Inis Cealtra was examined on the 5th May 2021. The lake habitat was categorised according to the Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). The lake was also visited on 3rd June and some additional observations were recorded. A qualitative assessment was made of substrate types with reference to particle size ranges in Fossitt (2000); topography; and plant species diversity and vegetation structure. The presence of Invasive Alien Species (terrestrial and aquatic) was noted. Submerged plants were

photographed and identified using plant identification keys. Publications used in plant identification included 'Aquatic plants in Britain and Ireland' by Preston and Croft (1997) and New flora of the British Isles by Stace (1997).



Plate 1 Hand searching for white-clawed crayfish.



Plate 2 White-clawed crayfish refuge trap (left). Sample of macroinvertebrates collected from Lough Derg at Inis Cealtra in May 2021 (right).

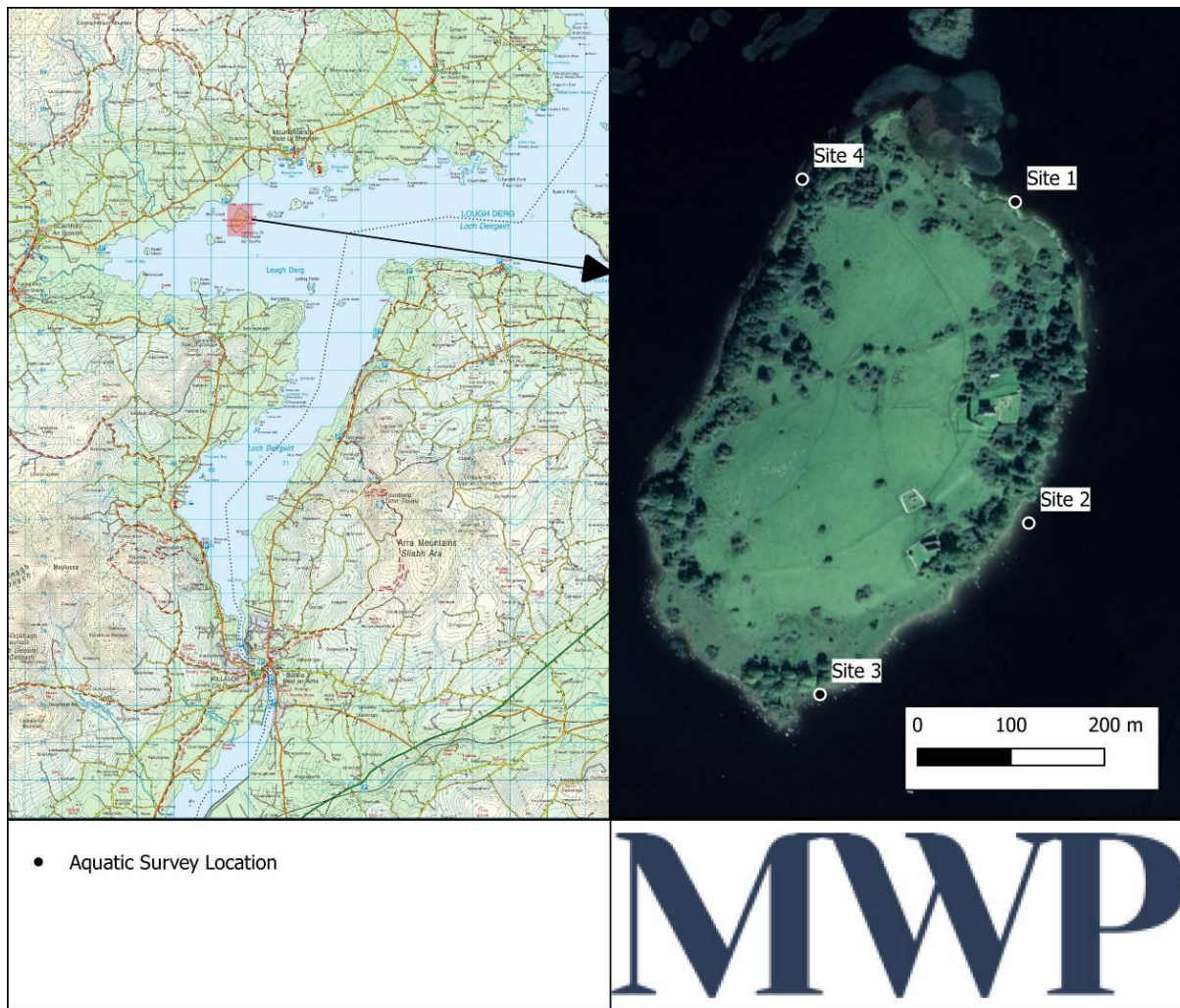


Figure 2 Location of the study sites at Inis Cealtra, Co. Clare.

2.2 Macroinvertebrates

2.2.1 General

Littoral macro-invertebrates were sampled at the Site 1 to a depth of 1 meter on with reference to particle size ranges in Fossitt (2000). The sampling methodology described in the EPA manual by Irvine et al. (2001) was followed. The invertebrates were collected via disturbing the substratum by 'kick sampling' and passing a hand net (mesh size 0.5 mm; 350 mm diameter) through the water above the disturbed area. All habitats in the chosen sampling site were sampled within a 3-minute period. In addition, a pre-sample sweep to collect surface dwelling invertebrates and a post sample manual search, lasting one minute, was undertaken during which any invertebrates attached to submerged plant stems, stones, logs or other solid surfaces were collected by hand and placed in the net.

Macroinvertebrates were combined and sorted from debris on a white tray and identified to at least family level with the aid of a hand lens and keys produced by the Freshwater Biological Association (see references section). The results are presented as species lists and also biotic indices (BMWP and ASPT) were derived. These indices were designed for use in rivers, so are used for comparative purposes with previous studies only.

2.2.2 White-clawed Crayfish

Surveying for white-clawed crayfish *Austropotamobius pallipes* was carried out in littoral habitats at four locations around Inis Cealtra as indicated in Figure 1 and Table 1. A licence to survey for white-clawed crayfish was obtained from NPWS (Licence No. C144 / 2021). Surveying involved hand searching and setting of crayfish refuge traps by snorkelling.

The hand search survey was carried out on 5th May 2021 during bright weather and calm conditions. Methodology followed 'Monitoring the White-clawed Crayfish *Austropotamobius pallipes* (Peay, 2003) and 'A technical manual for monitoring of the White-clawed Crayfish *Austropotamobius pallipes* in Irish lakes (Reynolds et al. 2010).

Crayfish refuge traps were placed beside a boulder at the locations listed on 5th May 2021. They were retrieved and examined for the presence of invertebrates on the 3rd June 2021.

Any fish captured during biological sampling and snorkelling were recorded. Any fish captured were identified with reference to the Freshwater Biological Association's publication 'Key to British Freshwater Fish with notes on their ecology and distribution' (Maitland, 2004) and other referenced sources.

Table 1. Location of aquatic survey sites at Inis Cealtra in 2021.

Site	Location	Irish reference grid	Survey	
			Crayfish (HS + RT)	General macroinvertebrates
Site 1	Northern shore at proposed new mooring point	569874 685275	✓	✓
Site 2	north-eastern shore	569890 684930	✓	
Site 3	Near the southern end of Inis Cealtra	569666 684747	✓	
Site 4	Ca. 80m south of pier on northwest shore	569647 685300	✓	



Plate 3 Aquatic survey Site 1 on the north-eastern shore (left) and Site 2 on the north-eastern shore (right).



Plate 4 Aquatic survey Site 3 near the southern end of Inis Cealtra (left) and Site 2 near the pier (right).

2.3 Biological Water Quality

The revised BMWP (Biological Monitoring Working Party) scheme by Walley and Hawkes (1997) was used to assign a biological water quality rating at Site 1. The BMWP score is a biotic index of water quality where each family recorded in the sample is assigned a habitat specific score. This score depends on the pollution sensitivity of the invertebrate family together with the characteristics of the site where the invertebrates were found. The BMWP score is the sum of the individual scores of the families recorded at each site - a family scores if present. A higher BMWP score is considered to reflect a better water quality and a score over 100 is indicative of very good water quality.

Site 1 was allocated an Average Score Per Taxa (ASPT). The ASPT index calculation is based on the average value of each taxa (families) sampled is calculated by summing up the indicator values and their division by numbers of taxa (families) sampled and ranges from 0 to 10. A high ASPT index values indicates thus high ecological status

and low values indicate bad/degraded ecological status. In general, the higher the number of taxa present, the better the biological quality, especially where the ASPT values are high (greater than 5.5).

2.4 Biosecurity

Biosecurity measures were used during all surveys according to 'Inland Fisheries Ireland Biosecurity Protocol for Field Survey Work' (IFI, 2010). All gear used had been thoroughly dried out for one month prior to use. Gear was cleaned and disinfected with spray bleach after surveying and before departing from site. Gear was then allowed to dry thoroughly for one week.

3. Results

The habitats within the entire study area are described in section 3.1. The riverine (fluvial) habitat of the River Fergus and associated fauna is described in Section 3.2.1 and Section 3.2.2, respectively.

3.1 Habitats and Flora

Using Fossitt (2000) criteria, Lough Derg in the environs of Inis Cealtra is classified as a Limestone-marl lakes (FL3). This habitat has a relationship with the EU Annex I habitat 'Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (3140)'.

The emergent plants common reed (*Phragmites australis*), water lily (*Nuphar lutea*), water horsetail (*Equisetum fluvatile*), common club-rush (*Schoenoplectus lacustris*) and bottle sedge (*Carex rostrata*) were present at Site 1 and the northern end of the island. *Elodea* sp., a submerged non-native invasive plant was recorded at Site 1.

Habitat has a key influence on the macroinvertebrate and fish communities which occur in lakes, with different animals occupying different niches. The substrates of Lough Derg around Inis Cealtra comprise an array of particles ranging from loose rocky material (boulders >256 mm) to sediment (fine sand 0.063-0.25). The lacustrine habitats along the shores of Inis Cealtra therefore provide refuge for a variety of aquatic fauna. The substrates around Inis Cealtra are mostly large. This is likely an effect of the bathymetric characteristics and aspect of the island relative to the prevailing south-westerly winds and the associated episodic high energy environment during unsettled periods of weather. The more sheltered and shallow northern shore, and adjacent lake habitat has a greater proportion of finer sediments and emergent macrophytes.

Some random massive boulders are strewn along the shores, providing some shelter from wave action. During the course of the current survey, substrates were found to have a significant cover of a marl material. The composition of this material was considered a combination of precipitated calcium carbonate, organic (diatomaceous complex) and inorganic (silt) components. On the later visit during June, increased algal growths were seen to increase the thickness of this lake-bed mass. Due to wave action, deposited suspended material on the shallows of the lake-bed at the margins was liberated with the effect of discolouring the water.

Yellow iris (*Iris pseudacorus*), marsh horsetail (*E. palustre*), meadowsweet (*Filipendula ulmaria*), marsh marigold (*Caltha palustris*) and hemlock water-dropwort (*Oenanthe crocata*) were the main components of the shoreside plant community. The terrestrial plant community as well as the aerial portion of emergent aquatic plants of Lough Derg are important resting and breeding sites for the terrestrial life stages of aquatic insects.



Plate 5 The northern shore of Inis Cealtra in May (left) and June (right) 2021.

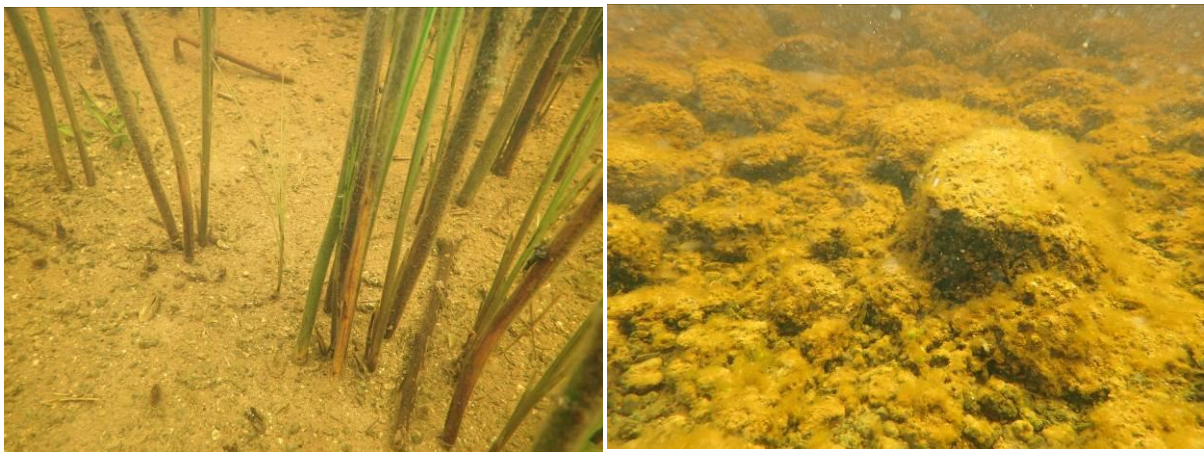


Plate 6 Soft substrate associated with a stand of common clubrush (left) and rocky substrate (right) at the northern shore.

3.2 Fauna

3.2.1 Fish

Roach *Rutilus rutilus*, perch *Perca fluviatilis* and brown trout *Salmo trutta* were recorded in the lake in the environs of the Inis Cealtra during the survey. Juvenile roach were abundant in the shallows.

Brown trout were seen taking insects from the surface of the water. This species spawns in the watercourses that feed Lough Derg, with the exception of the River Shannon which is largely too sluggish in its reach between Lough Ree and Lough Derf. The higher gradient streams such as the Annacarriga, Nenagh and Graney are suitable for salmonid reproduction and early life stage rearing. Lough Derg is an optimal habitat for adult trout, with an abundance of aquatic life for sustenance fish in general. Lough Derg is not a suitable salmonid spawning habitat with reference to Hendry & Cragg-Hine (2003).

The submerged aquatic plants and hard substrata of the lake at Inis Cealtra are likely used by spawning coarse fish. Eggs of a fish, possibly roach were found attached to the crayfish trap at Site 1.

European eel *Anguilla anguilla* occurs in Lough Derg but were not recorded during the hand searching carried out for white-clawed crayfish. It is noted that eel, like crayfish take refuge under rocks during day-time when they are less active and that 400 potential refuges were searched.

Spawning of pollan (*Coregonus autumnalis*) is considered to occur on exposed lake shores on gravelled areas in the shallow littoral in the December – January period (King et al. 2011). While there are no extensive gravel shoals around the island, there are some pockets of gravel potentially suitable for pollan spawning.



Plate 7 Three-spined stickleback and roach recorded during biological sampling (left). Male three-spined stickleback in a swan mussel shell (right).



Plate 8 Eggs of a fish attached to the crayfish trap at Site 1 (left). European eel *Anguilla anguilla* occurs in Lough Derg (right).

3.2.2 Macroinvertebrates

A broad diversity of aquatic macroinvertebrates was recorded in Lough Derg during May 2021. A total of twenty-seven families were recorded at Site 1 (See **Table 2**). It is noted that macroinvertebrates recorded at Site 1 can be expected to occur in comparable microhabitats around the shores of Inis Cealtra.

The macroinvertebrate assemblage at Site 1 was dominated by less tolerant and pollution tolerant taxa. The only pollution sensitive (group A) species recorded was the mayfly *Ephemera danica*. This species was numerous at larval stage and there was a considerable hatch of the species on the afternoon of the 5th May 2021 at the time of the current survey. The only other ephemeropteran recorded was *Caenis* sp. (few). Cased caddisfly at larval stage (*Limnephilidae*, *Athripsodes* sp.) and Molluscs (*Lymnaea peregra*, *L. stagnalis*, *Planorbis carinatus* and *P. planorbis*, *Bithynia tentaculata*, and *Theodoxus fluviatilis*) were well represented. Zebra mussel *Dreissena polymorpha* was numerous, while only shells of another bivalve, the swan mussel were the recorded. The crustaceans *Gammarus duebeni* and *Asellus aquaticus* were the most frequently occurring species. The bugs *Aphelocheirus aestivalis* and *Corixidae*, water mite (Order Hydracarina), aquatic earthworm (*Lumbriculidae*), flatworm (*Planariidae*) and alderfly larvae (*Sialis* sp.) were among the other macroinvertebrates recorded.

Table 2. Macroinvertebrates recorded during biological sampling carried out on northern shore (Site 1) of Inis Cealtra during May 2021.

	Pollution sensitivity group	Functional group	Relative abundance
MAYFLIES (Uniramia, Ephemeroptera)			
Hexes and big drakes (Ephemeridae)			
The green/grey drake mayfly <i>Ephemera danica</i>	A	Filtering collector	***
White midges (Caenidae)			
<i>Caenis</i> sp.	C	Gathering collector	*
CASED CADDIS FLIES (Trichoptera)			
Northern caddisflies (<i>Limnephilidae</i>)	B	Shredder	**
Cinnamon sedge <i>Limnephilus lunatus</i>	B	Shredder	**
Long horned caddisflies (<i>Leptoceridae</i>)	B	Shredder	***
Microcaddisflies (<i>Hydroptilidae</i>)			
<i>Indeterminate</i> sp.	B	Scraper	*
CASELESS CADDIS FLIES (Trichoptera)			
Trumpet-net caddisflies (<i>Polycentropodidae</i>)			

<i>Polycentropus sp.</i>	C	Filtering	
TRUE FLIES (Diptera)	collector	*	
Family Chironomidae			
Bloodworm <i>Chironomous sp.</i>			
Biting Midge (Ceratopogonidae)	E	Filtering collector	***
BEETLES (Coleoptera)	C		*
Whirligig beetle larvae (Gyrinidae)			
Common whirligig beetle <i>Gyrinus sp.</i>	C	Predator	
Diving beetles (Dytiscidae)	C	Predator	*
SNAILS (Mollusca, Gastropoda)	C	Predator	*
Family Lymnaeidae			
Wandering snail <i>Lymnaea peregra</i>			
Great pond snail <i>Lymnaea stagnalis</i>	D	Shredder	*
Family Planorbidae	C	Shredder	*
Keeled Ramshorn Snail <i>Planorbis carinatus</i>			
Great Ramshorn <i>Planorbis corneus</i>	C	Scraper	*
Family Hydrobiidae	C	Scraper	*
Common Bithynia <i>Bithynia tentaculata</i>			
Family Neritidae	C	Shredder	*
The Nerite <i>Theodoxus fluviatilis</i>			
MUSSELS (Mollusca, Bivalva)	C	Shredder	*
Orb/Pea Mussels (Sphaeriidae)			
Pisidium sp.	D	Filtering collector	
Zebra mussel (Dreissenidae)	D	Filtering collector	*
<i>Dreissena polymorpha</i>			

Unionidae	N/A	Filtering collector	***
Swan Mussel <i>Anodonta cygnaea</i>			
CRUSTACEANS (Crustacea)	C	Filtering collector	*1
Amphipods (Amphipoda, Gammaridae)			
Freshwater shrimp <i>Gammarus duebeni</i>			
Isopods, Asellidae	C	Shredder	***
<i>Asellus aquaticus</i>			
LEECHES (Hirudinae)	D	Shredder	*****
Erpobdellidae			
<i>Erpobdella</i> sp.			
Glossiphoniidae	D	Predator	*
<i>Glossiphonia complanata</i>			
<i>Helobdella stagnalis</i>	D	Predator	*
Hirudinae	D	Predator	
<i>Horse leech Haemopsis sanguisuga</i>			
BUGS (Hemiptera)	D	Predator	*
Broad shouldered water striders (Veliidae)			
<i>Microcrovelia</i> sp.			
Lesser water boatman (Corixidae)	C	Predator	**
Family Aphelocheiridae	C	Predator/scrapper	**
<i>Aphelocheirus aestivalis</i>			
ALDERFLIES (Megaloptera/)	B	Predator	*
Alderfly larvae (Sialidae)			
<i>Sialis</i> sp.			
SPIDERS (Crustacea, Arachnida)	D	Predator	***

Water mite (Order Hydracarina)					
SEGMENTED Clitellata)	WORMS (Annelida,	C	Predator	*	
Aquatic earthworm (Lumbriculidae)					
FLATWORMS (Platyhelminthes)		D	Gathering collector	*	
Planariidae					
No. of different families		E	Gathering collector	*	

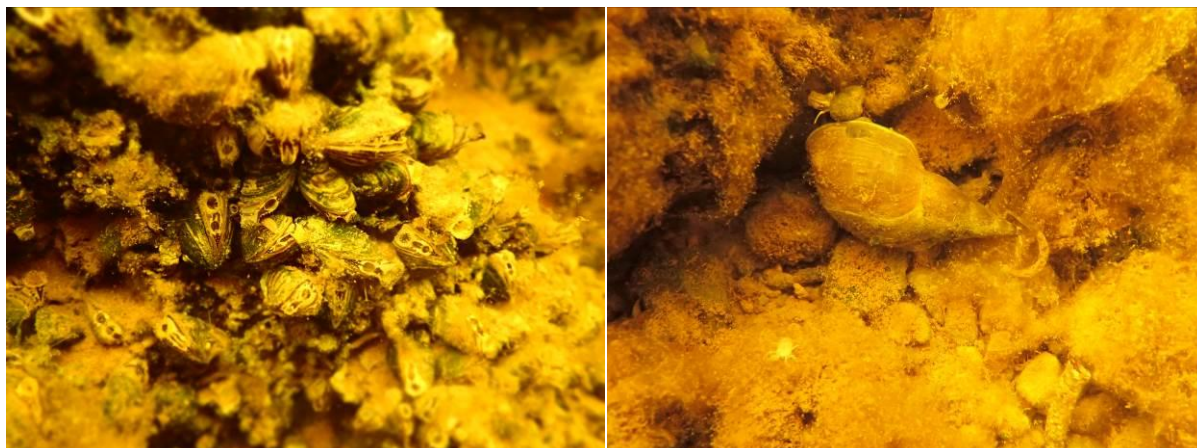


Plate 9 The molluscs zebra mussel *Dreissena polymorpha* (left) and great pond snail *Lymnaea peregra* (right)



Plate 10 The pollution tolerant leech *Glossiphonia complanata* (left) and larvae of the pollution sensitive mayfly *E. danica* (right)



Plate 11 *Ephemera danica* mayfly: subimago (left) and spent (right).



Plate 12 Larvae of mayfly *E. danica*. (left) and mayfly on the wing (right) are an important ecological feature of Lough Derg.

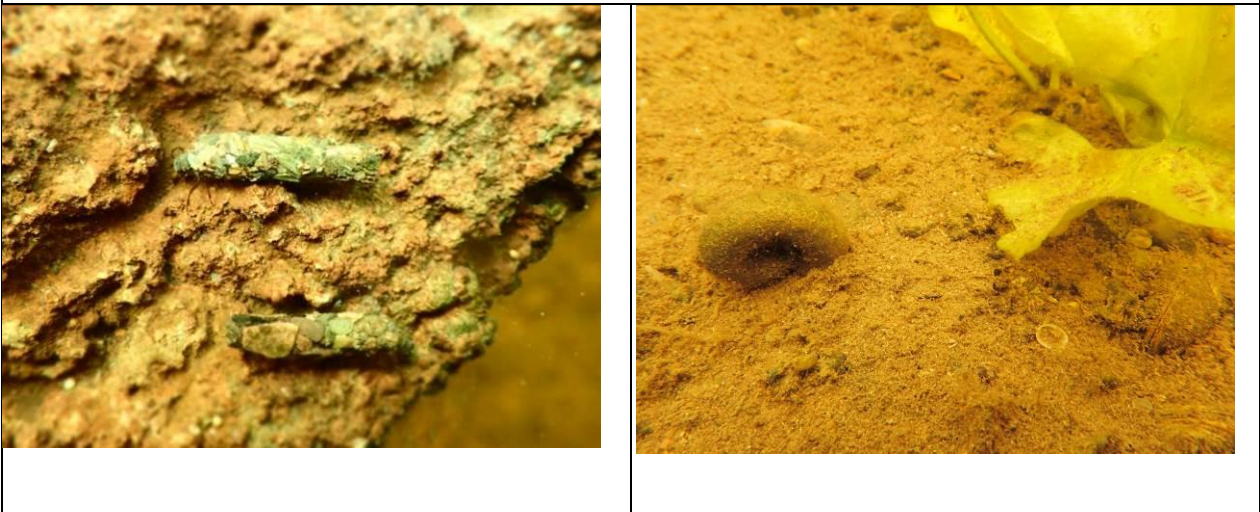


Plate 13 Larvae of Limnephilidae (right). Great ramshorn snail and basal growth of water lily (right).



Plate 14 Adult (aerial) stage of the aquatic macroinvertebrates *Sialis* sp. (left) and Limnephilidae (right).

3.3 Water Quality

Macroinvertebrate diversity at Site 1 was high and a BMWP score of 105.5. This score implies ‘good’ water quality and is interpreted as ‘unpolluted’. The ASPT score was 5.3, which represents less than good water quality. The ASPT, which is a function of the BMWP score, is deemed to more accurately gauge water quality as it is considered more robust and unambiguous than a BMWP score.

4. Discussion

The survey results are briefly discussed in this section. Information from the desk study is also presented. A separate section on non-native species has been provided given the proliferation of this group in Lough Derg. Changes in climatic conditions, eutrophication, algal blooms and fluctuating lake levels are all factors that can influence the aquatic ecology of the lake.

4.1 Habitats

Lough Derg has many small islands, especially on its western and northern sides. The shoreline is often fringed with swamp vegetation. Aquatic vegetation includes a range of charophyte species, including the Red Data Book species, *Chara tomentosa*. The shoreline is often fringed by swamp vegetation, comprised of such species as Common Reed (*Phragmites australis*), Great Fen-sedge (*Cladium mariscus*) and Bottle Sedge (*Carex rostrata*)¹.

A priority Annex I habitat, Cladium fen, occurs occasionally along the lake margins, mainly in association with alkaline fens, common reed (*Phragmites australis*) and other swamp vegetation. Typically, great fen-sedge (*Cladium mariscus*), which can be up to 2 m in height, forms dense stands. Associated species include common reed, black bog-rush (*Schoenus nigricans*), water horsetail, bottle sedge and occasional slender sedge (*Carex lasiocarpa*). This community generally merges with alkaline fen dominated by black bog-rush, with purple moor-grass (*Molinia caerulea*), marsh horsetail (*E. palustre*), meadowsweet and scattered tussocks of greater tussock-sedge (*Carex paniculata*)².

The littoral and lake marginal habitats of Inis Cealtra are common in the context of Lough Derg.

4.2 Fish

O'Reilly (1998) describes Lough Derg as "a great mixed fishery with salmon, trout, pollan and coarse fish all caught". A total of eight fish species and one type of hybrid were recorded on Lough Derg in June 2016 (Kelly *et al.* 2017)³. Roach was the most common fish species recorded, followed by perch, roach x bream hybrids, Brown trout, pike, eel, bream, pollan, and tench. During the previous surveys in 2009 and 2012 the same species composition was recorded, with the exception of pollan, which were not captured in the 2009 survey and tench, which were not captured in 2012.

Roach and perch, which were recorded during the current survey are non-native but protected: a maximum 4 fish per angler is permitted per day, and there is no killing of coarse fish > 25cm. Brown trout are native and afforded no such protection. Three-spined stickleback is one of the most widely distributed fish in the British Isles (Maitland and Campbell, 1992). The Irish status of stickleback is listed as 'least concern' in King *et al.* (2011).

European eel is listed as 'Critically endangered' and is now 'Red Listed' according to 'Red List No. 5: Amphibians, Reptiles & Freshwater Fish' (King *et al.*, 2011). The Shannon scheme and associated fish passage difficulties is likely affecting the abundance of eel in the Shannon system, as young eels cannot pass the dam at Ardnacrusha.

Lampreys, listed under Annex II of the E.U. Habitats Directive, are known to occur and the lake contains an apparently self-sustaining landlocked population of sea lamprey (*Petromyzon marinus*). A landlocked population,

¹ <https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004058.pdf>

² www.npws.ie/sites/default/files/protected-sites/synopsis/SY002241.pdf

³ http://wfdfish.ie/wp-content/uploads/2017/10/Derg_2016-1.pdf

where the fish are feeding and not completing a seaward migration, is unique in an Irish context, though there are several such populations in the U.S. and one is known from Loch Lomond in Scotland. Brook lamprey (*Lampetra planeri*) is known to be common in the lower Shannon catchment where all three lamprey species breed.

The endangered fish species Pollan (*Coregonus autumnalis pollan*) is recorded from Lough Derg. This species is found in three Shannon basin lakes – L. Derg, L. Ree and L. Allen (Harrison *et al.*, 2010). The coregonids are a cold-water group and, in Ireland, the species is at the southern limit of the range for coregonids or whitefish (King *et al.*, 2011). According to King *et al.* (2011), there are no population estimates from the Shannon lakes, but numbers thought to be very low. Enrichment of these lakes, combined with thermal stratification, can lead to depletion of oxygen in the deep waters of the hypolimnion. If this occurs, pollan are squeezed between warmer surface water areas and deeper areas which, though cooler, may have reduced oxygen concentrations. The species feeds on a mix of plankton, insect larvae and some benthic food items, depending on site (King *et al.*, 2011).

4.3 Macroinvertebrates

The mesotrophic and calcium rich conditions of Lough Derg represents a productive body of water with reference to molluscs which require this mineral for shell growth. The combination of a variety of substrates and depths provides habitat for a range of aquatic macroinvertebrates.

Inis Cealtra and the south-western extents of Lough Derg are outside the mapped range of white-clawed crayfish (NPWS 2019). Lough Derg was surveyed by hand searching and sweep netting at two locations on the northern shore of Lough Derg during June 2007 (O'Connor *et al.* 2007). No crayfish were recorded however. During a personal communication with Waterways Ireland in 2021, it was reported that white-clawed crayfish were seen by divers in some of the western bays of the lake, so it is likely that the species does occur in at least low densities.

In lakes, freshwater crayfish are recognised as ‘keystone’⁴ species which have measurable impacts on benthic fauna and macrophytes (Reynolds, 1998). Owing to the likely complex relationship between Crayfish and the lake ecology of Lough Derg, the results obtained during the current survey could be interpreted in multiple ways. Significant algal growth in the shallows of Lough Derg was recorded at all four survey locations, with levels increased significantly between May and June. It is considered that algae in Lough Derg could be affecting other plants due to competition for light. Reduced crayfish densities could explain increased plant aquatic growth, or enrichment/siltation etc. could explain more algal growth and less abundance of other plants upon which crayfish feed. Calcified plants such as charophytes are attractive to crayfish as they offer a ready source of calcium during the moulting process (Holdich, 2003), and any impacts on the food of crayfish will also impact on crayfish abundance. The grazing impacts of crayfish on aquatic macrophytes have long been known; their grazing checks primary productivity and in their absence, luxuriant macrophyte growth may occur (Reynolds, 1998). The proliferation non-native species has likely had an impact on the species.

E. danica is a widely distributed species occurring in lakes and the slow-flowing sections of rivers where bottom substrates support its burrowing habit. The nymphs are particularly common in alkaline waters perhaps because of the occurrence of marl in the substratum. The species is sensitive to organic pollution/eutrophication but is moderately tolerant of sedimentation (Kelly-Quinn & Regan, 2012). The caenid mayfly recorded was deemed either *C. horaria* or *C. luctuosa*, species generally associated with silty, depositing habitats. They are widely

⁴ White-clawed crayfish are now generally considered as a keystone species wherever they occur rather than a bio-indicator because of its traditional importance, large size, longevity and dominant position in the ecosystem (Matthews & Reynolds, 1992).

distributed in Ireland especially in lakes, ponds and slow flowing sections of large river and is relatively tolerant of the effects of organic pollution/eutrophication and siltation of its habitat (Kelly-Quinn & Regan, 2012).

The swan mussel is a species of stagnant muddy or silty habitats. This species may occur in the silt associated with reedbeds at the northern end of the island, but live specimens were not detected during the current survey. There are a total of 31 Irish non-marine molluscan species that either have a threat status or with important Irish populations (Moorkens, 2006), including Swan Mussel. The IUCN status of *A. cygnaea* is 'Vulnerable' (Byrne et al., 2009) and its threat status is 'Vulnerable' (Moorkens, 2006).

4.4 Non native invasive species

Alien aquatic species may cause significant changes to lake ecology through disruption and competition. Lough Derg has numerous non-native invasive species of which Canadian pondweed and zebra mussel were recorded during the current survey. Seven invasive aquatic plant species recorded in Lough Derg (Minchin & Boelens, 2011) are "Most Wanted" or "Problematic" invasive species according to the Invasive Species Ireland National Invasive Species Database. These are water fern (*Azolla filiculoides*), Canadian pondweed, Nuttall's waterweed (*Elodea nuttalli*), water violet (*Hottonia palustris*), common duckweed (*Lemna minuta*), and water soldier (*Stratiotes aloides*). The *Elodea* species, water fern and water soldier are also listed under Schedule 3 to the Bird and Habitat Regulations under which it is an offence to cause or allow their spread. These are spread via movement of live vegetative material on boating and fishing equipment.

The invasive zebra mussel is abundant in Lough Derg, which was found to have one of the largest densities of mussels in the Shannon-Boyle navigation system in surveys in 2000 and 2001. The species has been expanding its range in the lough in recent years, and has led to the decline of two native mussel species in the Shannon system (Minchin *et al.*, 2002). The zebra mussel is small but prolific mussel is a native of the Caspian and Black Seas region and was introduced through ballast water to the Shannon Estuary in the 1990s. They have spread from this area, principally via boat movements, throughout the Shannon and Shannon-Erne catchments. The female mussel can release up to 1 million eggs each year. These are carried in water currents and settle out after approximately three weeks. They are filter feeders and remove much of the plankton that juvenile fish depend upon. Hence, they may cause an imbalance in fish communities. They attach to hard surfaces such as boats, buoys and water intake pipes⁵.

The mussel improves water clarity by filtering particulate matter. However, despite the associated benefits to water quality, and the prey items zebra mussels provide for tufted duck, goldeneye and other species, zebra mussels outcompete native mussels that may also form part of wetland bird diets, and pose a potential risk to the lough ecosystem in the long term. The improvement of water clarity by zebra mussel has accelerated the spread of these macrophytes as they can root deeper into the water column due to increased light penetration (Minchin & Boelens, 2011). The zebra mussel may have displaced the native swan mussel from the northern shore of Inis Cealtra, where only shells of the swan mussel were recorded.

The Asian clam (*Corbicula fluminea*) was recorded in both the River Shannon and Lough Derg in surveys in 2011 and 2012 (Minchin, 2014). In Lough Derg it is apparently restricted to the northern third of the lake, and Dromineer Bay approximately half-way down the lake (Minchin). As with zebra mussels, Asian clams are suspension feeders that can reduce particulate matter resulting in increased water clarity and plant growth which at Lough Derg includes several invasive plant species. They may also deplete dissolved oxygen leading to mortality

⁵ <https://www.fisheriesireland.ie/Invasive-species-list/zebra-mussel.html>

of crustaceans and their fish predators. Both the Zebra mussel and the Asian clam are listed under Schedule 3 to the Bird and Habitat Regulations 2011 S.I 477 of 2011, under which it is an offence to offer for sale or introduce these species. These species are thought to spread via fishing equipment, waders, bilge water, and engine-cooling water, via macrophytes vegetation attached to boating equipment, or can break off from boat hulls under their own weight if in dense clusters. Passive spread by water currents and via waterbirds preying the mussels is also possible.

4.5 Water quality

Lough Derg and the nearby reaches of the River Shannon are part of the Lough Derg Water Management Unit of the Shannon River Basin Management Plan 2009- 2015. According to the plan, the River and Lough are of “Moderate” water quality status. All the rivers feeding the northern part of the Lough are of “Moderate” or “Poor” Water quality status while the majority of rivers flowing into the southern part of the Lough are of “High” or “Good” water quality status. As with all river catchments in Ireland, agriculture is the predominant polluting nutrient source (71% of total phosphorous). Waste water Treatment Plants (WwTPs) also significantly contribute to nutrient inputs, and fourteen 14 WwTPs are at risk within the Lough Derg Water Management Unit of the Shannon River Basin District Management Plan 2009-2015.

5. Recommendations

Strict measures will be deployed during construction to prevent the spread of Invasive Aquatic Species (IAS) to other waterbodies. All staff working at the site and making deliveries to and from the Site will be notified about zebra mussel (*Dreissena polymorpha*) which has infested the the proposed new mooring area. This organism and other non-native invasive species could be carried on wet equipment to other waterbodies sites and control is essential to prevent spread to other unaffected waterbodies in Ireland. Anyone in contact with lake water will observe the ‘Check, Clean and Dry’ protocol before entering the Site and again before leaving the Site. All wet gear (boats, clothing and equipment), vessels/machinery in contact with water (piling rigs, lifting machinery etc.) and all equipment/materials in contact with water will be checked for any silt, mud plant material or animals, cleaned if such fragments are attached and finally dried. Disinfectant or hot water (>40°C) will be used to clean all equipment before leaving the Site and this will be followed by a 24-hour drying period. The drying period is especially important in ensuring that all equipment is clear of infectious organisms, including the removal of any water inside boats. Zebra mussel can survive in damp equipment in excess of 5 days.

Each member of staff will be aware of the risks and be vigilant with regard to their responsibility to ensure water and non-native species are not spread to other waterbodies. The managers at the Site will be responsible for ensuring all new staff are aware of the procedures necessary to contain Zebra mussel. A toolbox talk will be given to appointed contractor at the Site by a suitably qualified person prior to the works, to brief staff on the importance of biosecurity and measures required to prevent spreading. The IFI documents ‘Invasive species biosecurity guidelines for boaters’ (IFI, 2013)⁶ and ‘Invasive species biosecurity guidelines for scuba diving’ (IFI, 2011)⁷ will be available at the Site Compound for the duration of the works (see **Appendix 1**). The protocols in these documents will form the basis of biosecurity during the proposed works. The above guidance documents in

⁶ <https://www.fisheriesireland.ie/extranet/invasive-species-1/360-invasive-species-biosecurity-guidelines-for-boaters-leaflet-1.html>

⁷ <https://www.fisheriesireland.ie/biosecurity-guidelines-for-scuba-diving.html>

relation to non-native species outline the necessary measures for all staff in contact with the water or using equipment in contact with water.

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Appendix 1

Biosecurity Measures



STOP!
**The spread of
harmful invasive species
and pathogens**

Disinfection of Scuba Diving Equipment

Aquatic Invasive Species (AIS) and fish parasites or diseases are readily transferred from one water body to another on diving gear, boats and protective clothing. These can be very damaging to resident fish stocks, the aquatic habitat and the general environment. In order to ensure that invasive species and fish diseases are not inadvertently transferred into Ireland's freshwaters from abroad or within the country from an infested area to one that is free from these organisms, it is essential that all diving equipment is routinely inspected and disinfected following each diving trip.

Items of diving equipment that require attention might include:

Diving suits, BCDs, diving cylinders, weights, weight belts, regulators, gauges; diving accessories such as masks, snorkels, fins, hoods, gloves, SMBs and reels; and boats, outboard motors and trailers.

Prior to leaving any dive site following a diving trip, the diver should routinely visually **inspect** all equipment that has been used in or exposed to the water. **Remove** and safely **dispose** of all attached plant or animal material. **Clean** and **disinfect** the equipment at the water's edge or later, as appropriate, making reference to the suggestions below.

The best method of disinfection is drying equipment thoroughly for a minimum period of 1 week.

Diving suits, BCDs, regulators, diving cylinders and accessories

- Thorough visual inspection for organic debris including in the pockets of the diving suit and BCD. Remove and dispose of any debris found, gently dry brush and hose down exposed surfaces with clean freshwater in a biosecure manner.
- Drain the BCD bladder.
- Immerse and lightly scrub equipment in an appropriate proprietary disinfectant solution following the manufacturer's guidelines, then rinse in clean freshwater and allow to dry out thoroughly.
- Rinse the inside of the BCD bladder in the same manner.
- When choosing an appropriate disinfectant to use, ensure that this does not have the potential to degrade the material integrity of the particular diving item being treated and does not invalidate any equipment warranty.



Information Update 02/11/11

Be biosecurity aware! To avoid the risk of introducing and/or spreading harmful aquatic invasive species or pathogens, please clean and disinfect any equipment that has been used or come into contact with water. For best practice guidelines refer to:
<http://www.fisheriesireland.ie/invasive-species/invasive-species.html>

**For information and to report
LO-CALL: 1890 34 74 24**



Boats, Outboard Motors and Trailers

- Visually inspect the boat, outboard motor and trailer once this equipment has been removed from the water. Remove all adherent plant and animal material and dispose of these in sealed bags.
- Visually inspect and thoroughly clean the anchor, ropes and any other equipment used in the boat during the diving trip. These should also be immersed in disinfectant solution (e.g. 1% solution of Virkon Aquatic or another proprietary disinfection product) and dried thereafter.
- Drain all water from the boat and from the outboard motor before moving to a different water body.
- Where possible, power hose the interior and exterior of the boat using heated water (60 °C/140°F). Where this is not possible, the boat should be washed before leaving the water body and not reintroduced to any water for a period of 5 days.
- Cooling water should be drained from the outboard motor and, where possible, it should be flushed with disinfectant solution.



Protective gloves should always be worn when handling disinfectant and the manufacturers' guidelines should be rigorously adhered to.

To learn more about invasive species visit www.caisie.ie



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

Information Update 02/11/11



CAISIE is the acronym for the 'Control of Aquatic Invasive Species and the Restoration of Natural Communities in Ireland' and forms part of the European Commissions Life+ funded programme which is the Financial Instrument for the Environment. The Department of the Environment, Heritage and Local Government are co-financiers.

The primary purpose of the project is to control and possibly eradicate aquatic invasive species in Lough Corrib and on the Grand Canal and Barrow Navigation. The project commenced in September 2009 with the scheduled for completion of January 2013.

Raising awareness through stakeholder engagement is key to the success of this project.

Please report sightings to info@caisie.ie
www.fisheriesireland.ie/invasive-species/
www.caisie.ie or FREEPHONE 1890 34 74 24



This project is funded by the EU Commissions Life+ Programme ©

(Produced and issued in Draft 2/06/11)



Ireland is replete with quality watercourses that cater for a wide diversity of water user groups. In recent years an extensive navigation network for cruisers and other pleasure craft has been created and this is attracting enthusiasts from all over the globe. Facilities for operators of small craft, including angling boats, powerboats, jet skis, sailing craft, kayaks, rowing boats and canoes, are also readily available in a wide range of aquatic habitat settings throughout the country.

Boats and other watercraft are known to facilitate the introduction and spread of environmentally damaging invasive species and fish pathogens. These may be carried from one water body to another as

- hull fouling organisms,
- in bilge or wet well water; or

- entangled on trailers, outboard motors or anchor chains and ropes.

Such inadvertent introductions of invasive species or pathogens can dramatically alter the ecology of receiving watercourses and render them unavailable for navigation or any other water-based pursuit. They can also result in a deterioration in water quality and significant fish mortality.

In order to minimise the risk of introducing invasive species or pathogens to Irish watercourses or the spread of these unwelcome visitors within the country via watercraft, it is essential that basic biosecurity measures are adhered to.



Standard Cleaning and Disinfection Measures

For motorised watercraft that remain in the water for long periods

For some watercraft operators it is impractical or undesirable to remove their boat from the water during the boating season and some choose to leave their boats in the water for even longer periods. Good biosecurity practice for these boaters involves the following:

- Regularly spray or clean the exposed part of the hull, the bilge area including any livewells or baitwells, the deck and any fixed equipment with a 1% solution of Virkon® Aquatic (or another proprietary disinfectant). The bilge pump should be used to expel any residual disinfectant solution.
- Before moving from one watercourse to another (e.g. River Shannon to Grand Canal), stop the boat and visually inspect the hull, exposed engine parts and any other possible sources of contamination for attached plant or animal material or debris. Remove and safely dispose of this before proceeding. Much of the material can be composted or removed to a municipal recycling centre.

- Clean and disinfect any livewells, baitwells or other likely sources of contaminant water.
- Flush the bilge with disinfectant solution before proceeding.
- When the boat is removed from the water, ensure that the cleaning and disinfection measures listed below are adhered to.

For watercraft that are removed from the water after use

These measures should be routinely operated where a boat or other craft is being removed from a watercourse, whether for safe storage or for transfer to another watercourse.

On removal, visually **inspect** all surfaces and equipment that have been exposed to the water. **Remove** and safely **dispose** of all attached plant and animal material, mud or associated debris from the boat, exposed engine parts and trailer. Drain all water from the boat, livewells, baitwells, anchor recess and bilge. **Clean** and **disinfect** the boat and all equipment that was used while the boat was afloat.

The specific cleaning and disinfection procedures that should be followed for various classes of craft include:

Motorised Watercraft

- Ideally, the trailer, hull, bilge area including any livewells or baitwells, deck and any fixed equipment should be sprayed with a 1% solution of Virkon® Aquatic (or another proprietary disinfectant). The bilge pump (in larger craft) should be used to expel any residual disinfectant solution.
- Alternatively, the trailer, hull, bilge area including any livewells or baitwells, deck and any fixed equipment should be power-hosed with heated water (60 °C/140° F) and residual water cleared using the bilge pump.
- Where an outboard motor is used, the cooling system should be flushed out with the Virkon® solution or another proprietary disinfectant.
- Other equipment used in the boat, including oars, row locks, anchors, ropes, buoys, fishing tackle and personal protective equipment (PPE), should be sprayed or cleaned with a 1% solution of Virkon® Aquatic (or another proprietary disinfectant) and left to dry.

Non-motorised Watercraft (e.g. canoes, kayaks, small sailing boats)

- These craft should be sprayed or thoroughly cleaned both inside and out using a 1% solution of Virkon® Aquatic (or another proprietary disinfectant).
- Where practical, a volume of disinfection solution should be poured into the interior of the craft and all associated equipment and PPE used in the boating activity immersed to ensure a contact time with the disinfectant of at least 15 minutes.
- Where it is not possible to fill the craft, the associated equipment and PPE should be cleaned with the disinfection solution.

Dr Joe Caffrey

Senior Research Officer, Inland Fisheries Ireland

May 2011

Protective gloves should always be worn when handling disinfectant and the manufacturers' guidelines should be rigorously adhered to.

APPENDIX 10.3

BAT SURVEY OF MOUNTSHANNON RECTORY, MOUNTSHANNON, CO. CLARE



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

Bat Survey of Mountshannon Rectory, Mountshannon, Co. Clare



Report Prepared for
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May 2021

ABSTRACT

Structure:	Former rectory
Irish Grid Reference:	R71179 86699;
Latitude & Longitude:	52.930595, -8.4293662
Bat species Present:	Bat droppings of Brown long-eared bats in 3 separate locations in attic. Bat droppings at wall plate level at front of house 4+ Soprano pipistrelles roosting at top of wall plate to rear of building
Bird species present:	Jackdaws
Proposed Works:	Conversion of building into interpretative centre, Insertion of lift, some roof repairs
Impact on Bats:	There will be no impact on bats using this site if exit/entry points are retained.
Bat Survey by:	Caroline Shiel
Dates:	10 th May 2021 & 11 th May 2021

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1. SUMMARY

I was contracted by Malachy Walsh & Partners, Consulting Engineers to conduct a bat survey of Mountshannon Rectory in Mountshannon, Co. Clare. This building is to be converted into an interpretive centre for Inis Cealtra Island on Lough Derg.

The conversion will include the installation of a lift. The top of the lift shaft will project into the attic space of the building.

It is proposed to conduct limited roof repairs where necessary using existing slates.

The building was surveyed internally and externally for bats on 10th May 2021. Dusk and dawn bat detector surveys were conducted outside the building on 10th and 11th May 2021.

2. AIMS OF BAT SURVEY

(a) To determine the importance of the building for bats.

(b) To assess the impact of the proposed renovation works on bats using the site.

(c) To make recommendations in order to reduce the impact of renovation works on bats using the site.

3. INTRODUCTION

3.1 Bat Species

Bats belong to the Order Chiroptera and to date nine species are recorded as resident in Ireland. These nine species are divided into two families – Family Vespertilionidae which contain nine of our Irish species (Daubenton's bat *Myotis daubentonii*, Natterer's bat *Myotis nattereri*, Whiskered bat *Myotis mystacinus*, Leisler's bat *Nyctalus leisleri*, Long-eared bat *Plecotus auritus*, Soprano Pipistrelle *Pipistrellus pygmaeus*, Common Pipistrelle *Pipistrellus pipistrellus* and Nathusius Pipistrelle *Pipistrellus nathusii*) and one species in the family Rhinolophidae –the Lesser Horseshoe bat *Rhinolophus hipposideros*.

Brandt's bat *Myotis brandii* has only been recorded once in Ireland from a site in Co.

Wicklow and is classified as a vagrant. In 2013 a single male Greater horseshoe bat *Rhinolophus ferrumequinum* was recorded in Co. Wexford. This bat was also considered to be a vagrant. During the field season of 2020 recordings were made of a Greater horseshoe bat in Co. Wicklow. Further investigations are on going.

3.2 Legislation

The serious decline in bat populations both in Ireland and across Europe has led to conservation measures and appropriate legislation being drawn up and implemented in an attempt to stabilise population numbers. It is estimated that bat populations across Europe have decreased by up to 60% in the last 30 years. As they are highly specialised animals, bats serve as biological indicators and are often amongst the first animal species to show signs of population change due to the activities of man. Destruction of roosts and foraging areas, coupled with the widespread use of pesticides, are the key reasons for the decline in numbers of bats in Ireland. Efforts should be made to retain known bat colonies and methods to lessen disturbance to these animals should be incorporated into any development.

Bats' dependency on insects has left them vulnerable to habitat destruction, land drainage, agricultural intensification and increased use of pesticides. Their reliance on buildings has also made them vulnerable to building repairs and the use of chemicals for timber treatment. Roosting or hibernation sites in caves, mines, trees and disused buildings are also often lost to development.

Irish Legislation

Wildlife Act 1976 – In the Republic of Ireland, under Schedule 5 of the Wildlife Act 1976 all bats and their roosts are protected by law. It is an offence to disturb either without the appropriate licence. This Act was further strengthened by the Wildlife Amendment Act 2000.

E.U. Legislation

Under the Habitats Directive 1992 (EEC 92/43), each member state of the E.U. was requested to identify habitats of national importance and priority species of flora and fauna. These habitats are now designated as Special Areas of Conservation (SAC). In Ireland, all bat species, except one are classified as Annex IV species under the Habitats Directive. Annex IV species are species in need of strict protection. The exception is the Lesser Horseshoe bat which is an Annex II species (Priority Species). Annex II species are species requiring the designation of Special Areas of Conservation specifically for their protection. All species of bat in Ireland are strictly protected under the Habitats Directive to include deliberate disturbance of these species, particularly during the periods of breeding, rearing and hibernation. It also specifies deterioration or destruction of breeding or resting places.

International Legislation

Ireland has ratified two international wildlife laws pertaining to bats

- (a) The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982) – part of this convention stipulates that all bat species and their habitats are to be conserved.
- (b) The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, Enacted 1983). This was instigated to protect migrant species across all European boundaries.

4. PROPERTY: Former Rectory, Mountshannon, Co. Clare

Grid Reference: R71179 86699

The rectory building is situated on a large site north of the harbour in Mountshannon. The building is two storey with a natural slate roof. The rectory building faces south towards Lough Derg.

There is a newly renovated shed building to the rear of the house.



Figure 1 – Aerial photo showing location of the rectory building on site to north of Mountshannon Harbour

5. SURVEY METHODOLOGY

Daylight Inspection

The building was inspected both internally and externally for bats or signs of bats on 10th May 2021 during daylight hours.

The attic space of the building was systematically searched for signs of bats in the form of live bats, bat droppings, urine stains, culled insect fragments or dead bats. Access to the main attic was gained via a trapdoor on the upstairs landing. It was not possible to gain entry a lower attic to the rear of the building as there was no trap door. This section is indicated in Photo 3.

The walls of the building were examined for evidence of bats using a high powered torch (Maglite Rechargeable System), paying particular attention to gaps in the facias and slates. Window sills and floors were inspected for possible accumulations of droppings.

Bat Detector Survey

A dusk bat detector survey was conducted on 10th May 2021 from approximately 20 mins before sunset (Sunset 21.17) and ran until 23.00. The dusk bat detector survey was conducted by two surveyors. A dawn bat detector survey was conducted on 11th May 2021 and ran from 1.5 hours before sunrise until sunrise at 05.42.

Remote Acoustic Survey

A Songmeter 4 (Wildlife Acoustics) was set up in the attic space to record for a period of two weeks. This detector was set to record all bats calls during the night from 20 mins before sunset to 20 mins after sunset.

6. SURVEY CONSTRAINTS

This survey was conducted within the recommended time period for surveying bats in buildings which is May to end August. Weather was favourable for the dusk and dawn bat detector surveys.

7. SURVEY RESULTS

7.1 Daylight survey

The building was surveyed internally and externally for bats on 10th May 2021.

The survey of the attic space revealed small accumulations of droppings of Brown long eared bats in 3 separate locations, all directly below the ridge boards of the attic. Some of these droppings were considered to be relatively fresh. Samples of droppings were taken for DNA analysis, if necessary.

An accumulation of droppings was also recorded at wall plate level at the front of the house, possibly corresponding with the location of an exit/entry point used by bats.

7.2 Bat Detector Survey

A dusk bat detector survey was conducted at dusk on 10th May 2021 and ran for 2 hours. A dawn bat detector survey was conducted on 11th May 2021.

Dusk Bat Detector Survey

Weather = 100% Overcast, Breezy & dry. Temp = 12 C. The survey commenced approximately 20 mins before sunset (Sunset = 21.17) and was conducted by two surveyors, one positioned at the south eastern corner of the building and one at the western elevation of the building.

From 21.35 onwards up to 10 Soprano pipistrelles and 2 Common pipistrelles were recorded foraging in the lee of the mature tree line running along the western boundary of the site.

A single Soprano pipistrelle was recorded emerging from the rear elevation of the building but the exact position of the exit point was not seen.

Dawn Bat Detector Survey

Weather = Clear, calm & dry. Temperature = 7 C. Sunrise = 05.42

3-4 Soprano pipistrelles were recorded foraging in the lee of the mature tree line, as recorded during the dusk survey. Four Soprano pipistrelles were recorded entering the building through a damaged section of fascia at the rear of the building (Photos 7 & 8). Several Soprano pipistrelles remained foraging along the treeline after last bat had returned to Mountshannon rectory building. By 05.20 these bats had left the site to roost elsewhere

Remote Bat Detector Survey

Analysis revealed that no bats were recorded flying in the attic space during the survey period.

8. POTENTIAL IMPACTS OF THE PROPOSED WORKS ON BATS

Installation of lift

The installation of the lift shaft should be conducted between mid September and end of April to avoid disturbance of any bats that may be roosting in the attic space.

Re-roofing works

The soprano pipistrelles are not roosting in the attic space. The roost is most likely situated at wall plate level or else in the stonework of the wall. The repair of this section of damaged fascia should be supervised by an ecologist to ensure that bats can continue to gain access to their roost.

Attic space

The attic space would appear to be used only periodically by a single Brown long-eared bat. This bat is most likely exiting at the point on the wallplate at the front of the house where an accumulation of droppings were recorded (Photo 1). This exit point should also be retained.

9. RECOMMENDATIONS AND MITIGATION MEASURES

9.1 Derogation Licence

The proposed renovation work will require a derogation licence from the National Parks and Wildlife Service. Repair of the damaged fascia being used as an exit/entry point by Soprano pipistrelles should be supervised by an ecologist.

9.2 Timing of installation of lift

The installation of the lift shaft should be conducted between mid September and end of April to avoid disturbance of any bats that may be roosting in the attic space.

9.3 Additional emergence count

A further count of the Soprano pipistrelles should be conducted in July to establish maximum number of bats using the roost site.

9.4 Bat Access

If more extensive re-roofing works prove necessary additional exit points should be provided in the form of bat slates.

The model recommended is the Bat Access Vent available at www.leadworx.co.uk £33 each.

9.5 Wood Preservative

No timber within the attic space to be treated with wood preservative.

9.6 Retention of tree line

The mature treeline along the western boundary of the site should be retained. This is an important foraging area for both Soprano and Common pipistrelles.



Rated - ★★★★★

Prices from

£ 33.00 exc.VAT

£ 39.60 inc.VAT

Leadworx bat access vents are designed to provide safe passage for bats into roosting areas in lofts and roof voids whilst maintaining the water tight integrity of your roof. They are made from Code 4 sheet lead milled to **British Standard BS EN 12588**.

Watch The Video

View Full Spec

9.5 Procedure if Bats are found

If any bats are found during the course of this work, work must stop immediately and the local NPWS conservation ranger or other bat specialist contacted. If bats need to be removed they may only be handled by a licenced bat worker.

10. BIBLIOGRAPHY

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PHOTOGRAPHS



Photo 1 – south facing front elevation of rectory. The position where droppings of Brown long eared bats was found on the wall plate within the attic is indicated.



Photo 2 - western and rear elevations of rectory. Location of Soprano pipistrelle roost indicated



Photo 3 – eastern elevation of rectory. There was no access to the section of attic indicated.



Photo 4 – example of gap at top of walls between bricks and fascia where bats could gain entry



Photo 5 – Access to attic space gained by means of ladder through trap door in ceiling of landing



Photo 6 – Foraging area used by Soprano and Common pipistrelles at both dusk and dawn



Photo 7 – rear elevation of building at dawn showing location of Soprano pipistrelle roost



Photo 8 – close up of broken fascia where Soprano pipistrelles are entering site

APPENDIX 10.4

INIS CEALTA HABITAT SURVEY



VOLUME III

APPENDICES TO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024



Inis Cealtra



Habitat Survey

Prepared By:



Delichon Ecology

Prepared For:

Malachy Walsh & Partners



Inis Cealtra Habitat Survey

Revision	Document Number	Description	Prepared by	Checked by	Date
0	14_22	Habitat Survey	ED	ED	14/04/2022



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1. INTRODUCTION

Delichon Ecology were commissioned by Malachy Walsh & Partners to undertake a habitat survey of Inis Cealtra, Lough Derg, Co. Clare. The habitat survey was undertaken on Thursday June 10th 2021.

1.1 Study Area

Inis Cealtra is a small island located towards the southwest of Lough Derg. It is located approximately 300m from the mainland shore. The island is renowned for its ecclesiastical heritage and the remaining area of this built heritage is located towards the east of the island. The location of Inis Cealtra in the wider landscape of Lough Derg is shown in **Figure 1.1**. Lands contained within the curtilage of the extant ecclesiastical built heritage on the island are managed by the Office of Public Works (OPW) as a National Monument. The area around the ecclesiastical monuments is maintained with the curtilage being fenced and walled to protect these monuments from livestock.

Inis Cealtra is a low-lying island with its highest point towards the centre of the island rising to approximately 50m OD Malin. The island is approximately 18.6 ha in size. The bedrock geology of the island is Dinantian lower impure limestone while the subsoils consist of limestone till.

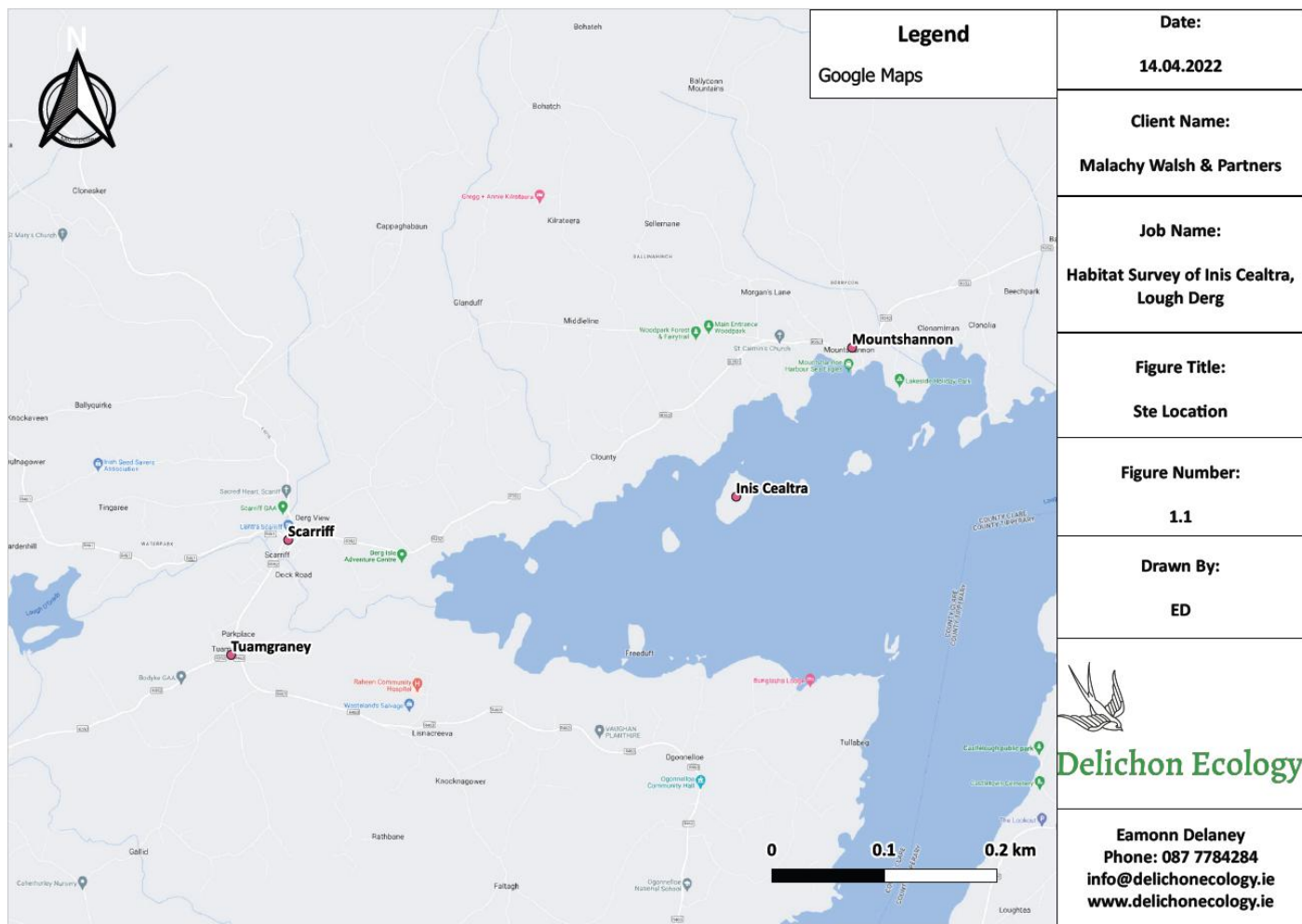


Figure 1-1 – Inis Cealtra Site Location



1.2 Statement of Authority

Eamonn Delaney undertook desk and field surveys and compiled and completed this Ecological Impact Assessment report. Eamonn holds a B.Sc. (Hons) in Science, and M.Sc. in Environmental Science. Eamonn has 15 years' experience in ecological consultancy. Eamonn is a full and Chartered Member of the Chartered Institute of Ecology and Environmental Management (CIEEM).



2 METHODOLOGY

2.1 Assessment Guidance Methodology

The habitat survey and assessment had regard to the following guidelines:

- EPA (2002) *Guidelines on the information to be contained in Environmental Impact Statements*, Environmental Protection Agency;
- EPA (2003), *Advice Notes on current practice in the preparation of Environmental Impact Statements*, Environmental Protection Agency;
- Fossitt, J. (2000) *A Guide to Habitats in Ireland*. Heritage Council, Kilkenny.
- NRA (2009) *Guidelines for the Assessment of Ecological Impacts of National Road Schemes Rev. 2*, National Roads Authority;
- NRA (2008) *Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes*, National Roads Authority;
- (NRA, 2008c) *Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*, National Roads Authority;
- Perrin, P.M., Barron, S.J., Roche, J.R. & O’Hanrahan, B. (2014). *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland*. Version 2.0. Irish Wildlife Manuals, No. 79. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland;
- CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, Version 1.1 Updated September 2019*. Chartered Institute of Ecology and Environmental Management, Winchester; and
- EPA (2017) *Guidelines on the information to be contained in Environmental Impact Assessment Reports*, Environmental Protection Agency.
- Smith, G. F., O’Donoghue, P., O’Hora, K. & Delaney, E. (2011) *Best Practice Guidance for Habitat Survey and Mapping*. Heritage Council, Kilkenny.

The assessment was carried out in two stages, firstly through a desktop study and secondly by field survey work in order to identify, describe and map areas of know or potential ecological value.

2.2 Desk Study

Sources of information that were used to inform the assessment were:

- Environmental Protection Agency (EPA) EnVision Mapping <https://gis.epa.ie/EPAMaps/>;
- EPA Catchments Website – for the 2nd cycle River Basin Management Planning www.catchments.ie;
- Geological Survey of Ireland online mapping www.gsi.ie;
- Information on the conservation status of birds in Ireland (Colhoun & Cummins, 2013);
- NPWS online maps and data, site synopsis and conservation objectives www.npws.ie
- National Biodiversity Data Centre (NBDC) online maps and data www.biodiversityireland.ie;
- OSI Map Viewer www.osi.ie;
- Botanical Society of Britain and Ireland online maps and data <https://bsbi.org/maps>;



- Any other relevant ecological reports and literature (published scientific literature and 'grey' literature).

2.3 Field Survey

The principal aim of the field survey was to identify and map habitats and their component plant species at Inis Cealtra. A Phase 1 Habitat Survey was undertaken as part of the site walkover survey. The methodology used during this survey was based on the Heritage Council's *Best Practice Guidance for Habitat Survey and Mapping* (2011)¹. The classification of habitats recorded during the field survey is based on the *A Guide to Habitats in Ireland* (Fossitt, 2000)². The *Guide to Habitats in Ireland* classifies habitats according to a hierarchical framework with Level 1 habitats representing broad habitat groups, Level 2 representing habitat subgroups and Level 3 representing individual habitat types. The Phase 1 Field Survey focused on identifying habitats to Level 3 of the *Guide to Habitats in Ireland*. Any other records of interest (e.g. invasive plant species) were also marked on field maps and locations were recorded using GPS handheld units.

The annotation of vegetation occurring within sites was undertaken using the DAFOR scale. This scale refers to plant species in terms of dominance, abundance, frequency, occasional and rare (DAFOR). All species were readily identifiable during the survey. Plant nomenclature for vascular plants follows 'New Flora of the British Isles' (Stace, 2019)³, while mosses and liverworts nomenclature follows 'Mosses and Liverworts of Britain and Ireland - a field guide' (British Bryological Society, 2010)⁴.

2.4 Evaluation

All ecological receptors within the project's zone of influence were assessed according to criteria for site evaluation outlined in the NRA *Guidelines for Ecological Impact Assessment of National Road Projects* (NRA, 2009). The geographic frame of reference used to determine the ecological value of receptors as they occurred within the project zone of influence are presented in

Table 2-1 - Ecological Site Assessment Scheme

Ratings for Ecological Sites
International Importance: 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. Proposed Special Protection Area (pSPA). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).

¹ Smith, G. F., O'Donoghue, P., O'Hara, K. & Delaney, E. (2011) *Best Practice Guidance for Habitat Survey and Mapping*. Heritage Council, Kilkenny.

² Fossitt, J. (2000) *A Guide to Habitats in Ireland*. Kilkenny: Heritage Council.

³ Stace, C. (2019) *New Flora of the British Isles*. Fourth Edition. C&M Floristics

⁴ Atherton, I. Bosanquet S. & Lawley, M (2010) *Mosses and Liverworts of Britain and Ireland a field guide*. British Bryological Society



Ratings for Ecological Sites

Features essential to maintaining the coherence of the Natura 2000 Network.

Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.

Resident or regularly occurring populations (assessed to be important at the national level) of the following:

Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or

Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.

Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).

World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).

Biosphere Reserve (UNESCO Man & the Biosphere Programme).

Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).

Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).

Biogenetic Reserve under the Council of Europe.

European Diploma Site under the Council of Europe.

Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).

National Importance:

Site designated or proposed as a Natural Heritage Area (NHA).

Statutory Nature Reserve.

Refuge for Fauna and Flora protected under the Wildlife Acts.

National Park.

Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.

Resident or regularly occurring populations (assessed to be important at the national level) of the following:

Species protected under the Wildlife Acts; and/or

Species listed on the relevant Red Data list.

Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.



Ratings for Ecological Sites

County Importance:

Area of Special Amenity.

Area subject to a Tree Preservation Order.

Area of High Amenity, or equivalent, designated under the County Development Plan.

Resident or regularly occurring populations (assessed to be important at the County level) of the following:

Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;

Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;

Species protected under the Wildlife Acts; and/or

Species listed on the relevant Red Data list.

Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.

County important populations of species or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared.

Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.

Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (higher value):

Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;

Resident or regularly occurring populations (assessed to be important at the Local level) of the following:

Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;

Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;

Species protected under the Wildlife Acts; and/or

Species listed on the relevant Red Data list.

Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;



Ratings for Ecological Sites

Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):

Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;

Sites or features containing non-native species that are of some importance in maintaining habitat links.

In summary, the habitats found are evaluated based on their naturalness, value and vulnerability, as well as their inclusion within the European site network. Habitats that are considered to be good examples of Annex I and Annex I Priority habitats are classed as being of International or National Importance. Semi-natural habitats with high biodiversity in a county context and that are vulnerable, are considered to be of County Importance. Habitats that are semi-natural, or locally important for wildlife, are considered to be of Local Importance (higher value) and sites containing small areas of semi-natural habitat or maintain connectivity between habitats are considered to be of Local Importance (lower value).



3 RESULTS

3.1 Phase 1 Habitat Survey

The findings of the Phase 1 habitat survey are described below, while a habitat map showing the extent of habitats at Inis Cealtra are presented in **Figure 3.1** below.

Inis Cealtra is an island on the western shores of Lough Derg. The island is influenced by grazing livestock, which maintain the elevated centre areas of the island as improved and semi-improved grassland habitats. The lower lying margins of the island are influenced by the rising and receding waters of Lough Derg and consequently support extensive but narrow areas of marsh, that in turn are adjoined by wet grassland. The island margins also support dry young woodland, characterised by semi-mature ash trees. If grazing was discontinued on the island, it is likely that the in-situ pastoral grassland habitats would evolve into rough grassland to scrub and eventually to young woodland. Inis Cealtra also supports extant ecclesiastical monuments, including a round tower, church and dry stone wall network near the eastern half of the island.

Descriptions of habitats identified at Inis Cealtra are provided below.

Improved Agricultural Grassland (GA1)

Semi-improved grassland comprises the majority of Inis Cealtra island. Its location is confined to the central section of the island on its higher reaches. This grassland is maintained through livestock grazing. There is no indication of ongoing improvement through fertilisation or reseeding. To that end, the sward supports a moderate diversity of grasses and forbs, including sweet vernal grass (*Anthoxanthum odoratum*), red fescue (*Festuca rubra*), perennial rye grass (*Lolium perenne*), common sorrel (*Rumex acetosa*), creeping thistle (*Cirsium arvense*), common mouse-ear (*Cerastium fontanum*), creeping bent (*Agrostis stolonifera*), germander speedwell (*Veronica chamaedrys*) and localised occurrences of common rush (*Juncus effusus*).

Amenity Grassland (GA2)

The areas surrounding the ecclesiastical buildings are maintained as amenity grassland. These areas support a shortened sward, maintained by frequent cutting / strimming. Plant species composition includes perennial rye grass, red fescue, sweet vernal grass, white clover (*Trifolium repens*), self heal (*Prunella vulgaris*) and the mosses *Rhytidiadelphus squarrosus* and *Calliergonella cuspidata*.

Dry Meadows and Grassy Verge Grassland (GS2)

This habitat occurs in mosaic with improved grassland and has developed due to the recent absence of mowing and grazing. Plant species composition includes rank and overgrown red fescue and cock's-foot (*Dactylis glomerata*) and meadow foxtail (*Alopecurus pratensis*).

Wet Grassland (GS4)

Wet grassland occurs locally on the island, the greatest extent of which is located near the southern boundary of the island. In other areas, wet grassland forms narrow transitional strips between the extensive marsh habitats on the island margins of the higher drier areas of improved grassland near the centre of the island. Plant species composition within this grassland habitat is characterised by tall stands of common rush and yellow iris (*Iris pseudacorus*). Plant species composition within the wet grassland habitats included compact rush (*Juncus conglomeratus*), common rush, yellow iris, brown



sedge (*Carex disticha*), sweet vernal grass, marsh pennywort (*Hydrocotyle vulgaris*), common spotted orchid (*Dactylorhiza fuchsii*), water mint (*Mentha aquatica*), water parsnip (*Berula erecta*), hard rush (*Juncus inflexus*), carnation sedge (*Carex panicea*), common spike rush (*Eleocharis palustris*), marsh thistle (*Cirsium palustre*), greater bird's foot trefoil (*Lotus pedunculatus*), hairy sedge (*Carex hirta*), cuckooflower (*Cardamine pratensis*) and tall fescue (*Schedonorus arundinaceus*).

Where yellow iris cover is reduced, the wet grassland habitat supported localised abundances of sharp flowered rush (*Juncus articulatus*) with occasional to locally frequent meadowsweet (*Filipendula ulmaria*), brown sedge, marsh bedstraw (*Galium palustre*), crested dog's tail (*Cynosurus cristatus*) and lesser stitchwort (*Stellaria graminea*).

Another strip of yellow iris abundant wet grassland habitat occurs near the northern boundary of the site on sloping ground.

Marsh (GM1)

Extensive but narrow fringes areas of marsh occur along the south-eastern, western and northern fringes of the island. This habitats are located on shoreline rocks and loosely stabilised, open substrate further inland. The marsh habitats are of the greatest botanical diversity on the island. Where this habitat occurs along the northern and eastern fringes of the island, it is characterised by localised abundances of yellow iris. Where yellow iris cover is reduced, the following broadleaved herbs and graminoids occur; hemlock water dropwort (*Oenanthe crocata*), creeping buttercup, greater bird's foot trefoil (*Lotus pedunculatus*), water mint (*Mentha aquatica*), gypsywort (*Lycopus europaeus*), brown sedge, lesser water parsnip (*Berula erecta*), meadowsweet, water horsetail (*Equisetum fluviatile*), curled dock (*Rumex crispus*), sneezewort (*Achillea ptarmica*), water forget-me-not (*Myosotis scorpioides*), tall fescue, tufted vetch (*Vicia cracca*), silverweed (*Potentilla anserina*), hard rush, brooklime (*Veronica beccabunga*), common fleabane (*Pulicaria dysenterica*), locally frequent common sedge (*Carex nigra*), marsh pennywort, ragged robin (*Silene flos-cuculi*), carnation sedge, marsh marigold (*Caltha palustris*), lesser spearwort (*Ranunculus flammula*), angelica (*Angelica sylvestris*), yellow pimpernel (*Lysimachia nemorum*), and occasional bogbean (*Menyanthes trifoliata*). Bryophyte species within this habitat included *Pseudoscleropodium purum*, *Calliergonella cuspidata*, *Cratoneuron filicinum*, *Brachythecium rutabulum* and *Climacium dendroides*.

Species composition changes slightly where this habitat is in transition to drier grassland habitat at higher elevations (as seen in the marsh near the southern boundary of the site), with noted reductions in broadleaved herb cover and the occurrence of hard rush, red fescue, bird's foot trefoil (*Lotus corniculatus*), occasional quaking grass (*Briza media*), locally frequent carnation sedge as well as common spotted orchid, meadowsweet, water mint and greater bird's foot trefoil.

Openings of marsh habitats occur near the south-western and western island fringe. These areas are again characterised by yellow iris, with meadowsweet, hemlock water dropwort, angelica, greater tussock sedge (*Carex paniculata*), tall fescue, bogbean, water horsetail, water mint, yellow pimpernel and lesser water parsnip. A locally flushed area near the south-western corner of the island supports a noted reduction in large herb cover and the occurrence of occasional black bog rush (*Schoenus nigricans*) in addition to water cress (*Nasturtium officinale* agg.), meadowsweet, marsh pennywort, carnation sedge, common valerian (*Valeriana officinalis*), water mint, marsh speedwell (*Veronica scutellata*) and marsh thistle. Locally elevated areas of outcropping rock support quaking grass, hairy



sedge (*Carex hirta*), ladies bedstraw (*Galium verum*), red fescue, crested dog's tail, square stalked St John's wort (*Hypericum perforatum*), yellow rattle (*Rhinanthus minor*) and bugle (*Ajuga reptans*).

Scrub (WS1)

Areas of scrub occur throughout the island, mostly along the interface between the woodland habitats on the islands edge and the higher drier areas of improved grassland near the centre of the island. Plant species composition includes extensive and spreading of bramble (*Rubus fruticosus* agg.) scrub with co-occurring and spreading nettle (*Urtica dioica*) and cleavers (*Galium aparine*). These areas of scrub also support localised occurrences of elder (*Sambucus nigra*) and blackthorn (*Prunus spinosa*).

Oak-ash-hazel woodland (WN2)

The island margins support young woodland cover near the east/ north-east, west and south-east fringes. Most of these woodland habitats have recently established and comprise tall thin ash (*Fraxinus excelsior*) trees.

The woodland near the north-east is poorly developed and is characteristic of an area of scrub transitioning to young woodland. The woodland canopy is relatively open or poorly defined. The structure comprises ash and locally frequent sycamore (*Acer pseudoplatanus*) trees overtopping elder, hawthorn (*Crataegus monogyna*), bramble and nettle. The ground layer is mostly dry, and the species composition supports extensive spread of nettle and bramble in addition to the localised occurrences of cowslip (*Primula veris*), bush vetch (*Vicia sepium*), wood dock (*Rumex sanguineus*), cleavers, ground ivy (*Glechoma hederacea*), herb Robert (*Geranium robertianum*), broad buckler fern (*Dryopteris dilatata*) and hart's tongue fern (*Asplenium scolopendrium*). The shoreline fringe of this woodland habitat supports a strip of yellow iris and occasional hemlock water dropwort growing on shoreline rocks.

Another area of emerging and establishing oak-ash-hazel woodland occurs near the southern margins of the island. The woodland canopy is again poorly formed and supports young ash trees overtopping extensive bramble with frequent and dense growing blackthorn, hawthorn, elder and buckthorn (*Rhamnus cathartica*) in the shrub layer.

The western margins of the island support the largest area of oak-ash-hazel woodland. This woodland is larger and is structurally more well established, evidenced by the almost continuous canopy cover of young, semi-mature ash trees and the initial development of woodland ground layer species. The woodland vegetation composition is similar to those previously described, comprising maturing ash overtopping sycamore, grey willow (*Salix cinerea* subsp. *oelifolia*) and goat willow (*Salix caprea*) trees. Alder occurs occasionally near the lakeshore margins with locally frequent buckthorn. The understorey shrub layer is open and is somewhat disturbed by cattle grazing and poaching. The shrub layer supports occasional hawthorn and elder, in addition to localised spreading of nettle and bramble in the understorey, particularly near the drier margins along the eastern boundary. Much of the ground layer is poorly developed, but localised occurrence of woodland ground layer species occur and include wood avens (*Geum urbanum*), lord's and ladies (*Arum maculatum*), wood dock (*Rumex sanguineus*), butterbur (*Petasites hybridus*), nettle, ground ivy, herb Robert (*Geranium robertianum*), rough meadow grass (*Poa trivialis*), germander speedwell, sanicle (*Sanicula europaeus*), wood sedge (*Carex sylvatica*), bluebell (*Hyacinthoides non-scripta*), bush vetch, cleavers (*Galium aparine*), creeping buttercup, common chickweed (*Stellaria media*), broad buckler fern and wood speedwell (*Veronica montana*). Sycamore regeneration was noted in parts of the woodland ground layer



Stone walls and other stonework (BL1)

This habitat includes the ecclesiastical buildings and stone walls. Plant species cover is sparse and restricted to epiphytes and bryophytes including rustyback (*Ceterach officinarum*), wall rue (*Asplenium ruta-muraria*), hart's tongue (*Asplenium scolopendrium*), red fescue, dandelion (*Taraxacum* agg.), herb Robert (*Geranium robertianum*) and bryophyte species including *Brachythecium rutabulum*, *Thamnobryum alopecurus* and *Tortula muralis*.

Buildings and Artificial Surfaces (BL3)

This habitat relates to the pier located near the north-western corner of the island. The pier is a man made structure, comprising cast in place concrete subject to the wave action of the lake water.

Habitat Evaluations

Table 3-1 - Evaluation of habitats at Inis Cealtra

Habitat	Evaluation ⁵	Evaluation Rationale
Stone walls and other stoneworks (BL1)	Local Importance – Lower Value / International Importance	A habitat of local importance of potential for small mammals and invertebrates.
Buildings and artificial surfaces (BL3)	Negligible / International Importance	A habitat of poor botanical diversity.
Improved agricultural grassland (GA1)	Local Importance – Lower Value / International Importance	A habitat of low botanical diversity, partially improved by livestock grazing.
Dry meadows and grassy verges (GS2)	Local Importance – Lower Value / International Importance	A habitat of low botanical diversity. May provide cover for small mammals and birds.
Amenity grassland (GA2)	Local Importance – Lower Value / International Importance	A habitat of low botanical diversity, maintained by ongoing mowing and strimming.
Marsh (GM1)	County Importance / International Importance	A habitat of rich botanical diversity and one of the key botanical habitats at Inis Cealtra. The marsh habitats at Inis Cealtra correspond to the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)'.
Wet grassland (GS4)	Local Importance – higher value /	A habitat of high botanical diversity and one of the key botanical habitats at Inis Cealtra.

⁵ As the island is located within the bounds of Lough Derg SPA, all habitats on site are considered to be of International Importance. The evaluation of these habitats on their own merit, separate from the SPA designation are also provided for context.



Habitat	Evaluation ⁵	Evaluation Rationale
	International Importance	
Oak-ash-hazel woodland (WN2)	Local Importance – higher value / International Importance	A habitat of moderate botanical diversity, likely to be of importance for passerine avifauna and small mammals.
Scrub (WS1)	Local Importance – higher value / International Importance	A habitat of moderate botanical diversity, likely to be of importance for passerine avifauna and small mammals.

Rare and Protected Flora

No rare or protected flora species were recorded on Inis Cealtra during the habitat and botanical survey completed on June 10th 2021. No existing records of protected flora are held by the NBDC⁶ or BSBI databases⁷ for Inis Cealtra.

⁶ <https://maps.biodiversityireland.ie/Map>

⁷ <https://database.bsbi.org/search.php>



Photos of the habitats at Inis Cealtra



Image 3-1 – Yellow Irish Marsh strip near the north fringe of the island



Image 3-2 – Marsh located along the eastern boundary of the island



Image 3-3 – Scrub and wet grassland near the south-eastern fringe of the site



Image 3-4 - Improved agricultural grassland located within the centre of the site

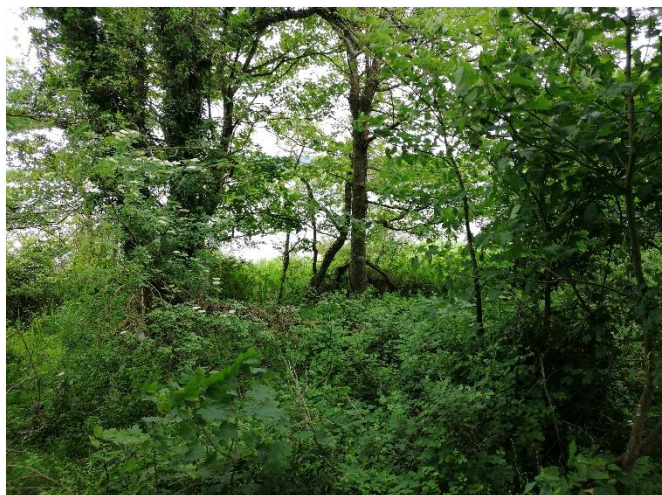


Image 3-5 – Broadleaved woodland located near the south-western fringes of the site



Image 3-6 – Reed and large sedge swamp located immediately north of Inis Cealtra

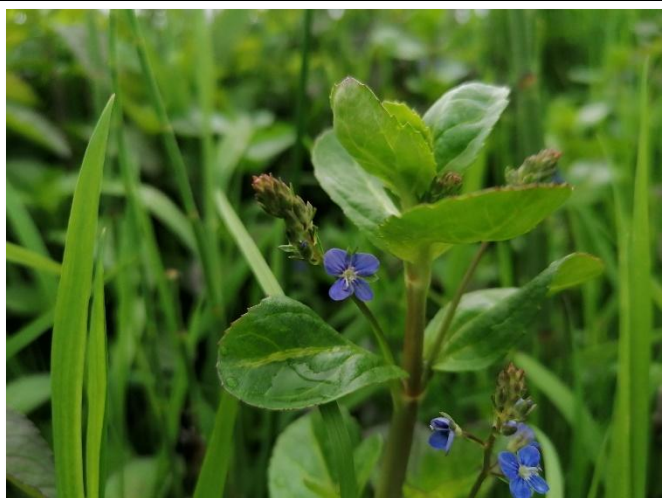


Image 3-7 – Veronica beccabunga growing within the marsh habitats



Image 3-8 – Common spotted orchid growing within the wet grassland habitat

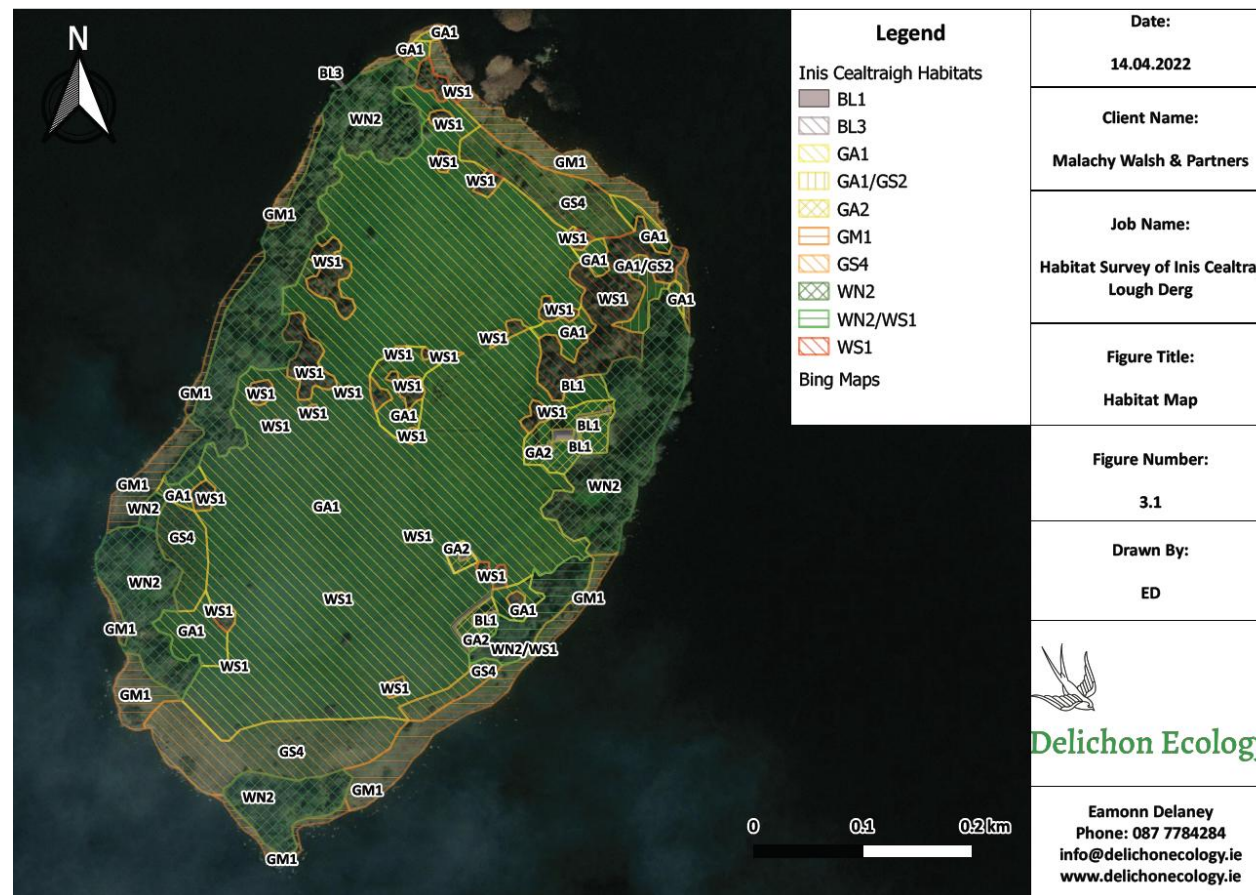


Figure 3-1 - Habitat Map of Inis Cealtra



APPENDIX 11.1

NOISE MONITORING LOCATION PHOTOS



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NML1



NML2



NML3



NML4



APPENDIX 11.2

NOISE MONITORING CALIBRATION CERTIFICATES



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NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to
Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

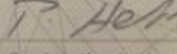
Certificate Number	242183
Item Calibrated	Larson Davis Sound Level Meter with PCB PCB377B02 Microphone
Serial Number	0003826 (SLM) and 150020 (Microphone)
ID Number	None
Order Number	30892
Date Received	09 May 2024
NMI Procedure Number	TFAP-NM-16

Method
The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).

Calibration Standards
Norsonic 1504A Calibration System incorporating:
SR DS360 Signal Generator, No. 0735 [Cal Due Date: 01 Sep 2024]
Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 01 Sep 2024]
B&K 4180 Measuring Microphone, No. 1069 [Cal Due Date: 15 Sep 2025]
B&K 4228 Pistonphone, No. 0741 [Cal Due Date: 14 Sep 2025]
B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 04 Jan 2025]

Calibrated by

David Fleming

Approved by

Paul Hetherington

Date of Calibration
11 Jun 2024

Date of Issue
11 Jun 2024



This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)



NSAI

National Metrology Laboratory

Certificate of Calibration

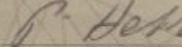
Issued to **Malachy Walsh & Partners**
Reen Point
Blennerville
Tralee
Co. Kerry

Certificate Number	242184
Item Calibrated	Larson Davis CAL200 Sound Level Calibrator
Serial Number	11262
ID Number	None
Order Number	30892
Date Received	09 May 2024
NML Procedure Number	TFAP-NM-11

Method	The above calibrator was allowed to stabilize for a suitable period in laboratory conditions. It was then calibrated by measuring the sound pressure level generated in its measuring cavity (half-inch configuration). The calibrator's operating frequency was also measured.
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Calibration Standards	Norsonic 1504A Calibration System incorporating: Agilent 34401A Digital Multimeter, File No. 0736 [Cal due: 01 Sep 2024] B & K 4180 Measuring Microphone, File No. 1069 [Cal due: 15 Sep 2025] B & K 4228 Pistonphone, File No. 0741 [Cal due: 14 Sep 2025]
-----------------------	--

Calibrated by	 David Fleming
---------------	--

Approved by	 Paul Hetherington
-------------	--

Date of Calibration	10 Jun 2024
---------------------	-------------

Date of Issue	11 Jun 2024
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This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)



NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

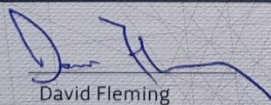
Attention of Peter Barry

Certificate Number	202870
Item Calibrated	Bruel & Kjaer 2250 Sound Level Meter with Type 4950 Microphone
Serial Number	2654709 (SLM) and 2657422 (Microphone)
ID Number	None
Order Number	24215
Date Received	10 Aug 2020
NML Procedure Number	AP-NM-09

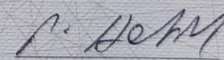
Method The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).

Calibration Standards Norsonic 1504A Calibration System incorporating:
SR DS360 Signal Generator, No. 0735 [Cal Due Date: 22 Apr 2021]
Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 24 Apr 2021]
B&K 4134 Measuring Microphone, No. 0743 [Cal Due Date: 27 May 2022]
B&K 4228 Pistonphone, No. 0741 [Cal Due Date: 26 May 2022]
B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 31 Aug 2020]

Calibrated by


David Fleming

Approved by


Paul Hetherington

Date of Calibration

26 Aug 2020

Date of Issue

26 Aug 2020



This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)



NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

Attention of Peter Barry

Certificate Number	215313
Item Calibrated	Brüel & Kjær Type 4231 Sound Level Calibrator
Serial Number	2665058
ID Number	None
Order Number	26313
Date Received	17 Dec 2021
NML Procedure Number	AP-NM-13

Method The above calibrator was allowed to stabilize for a suitable period in laboratory conditions. It was then calibrated by measuring the sound pressure level generated in its measuring cavity (half-inch configuration). The calibrator's operating frequency was also measured.

Calibration Standards Norsonic 1504A Calibration System incorporating:
Agilent 34401A Multimeter, No. 0736 [Cal due: 10 Jun 2022]
B & K 4134 Measuring Microphone, No. 0744 [Cal due: 03 Jun 2023]
B & K 4228 Pistonphone, No. 0740 [Cal due: 04 Jun 2023]

Calibrated by


David Fleming

Approved by


Paul Hetherington

Date of Calibration

21 Dec 2021

Date of Issue

21 Dec 2021



This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

APPENDIX 11.3

GLOSSARY OF NOISE RELATED TERMINOLOGY



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Terminology	Description
A-weighting	a filter that down-weights low frequency and high frequency sound to better represent the frequency response of the human ear when assessing the likely effects of noise on humans
acoustic character	one or more distinctive features of a sound (e.g. tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
acoustic screening	the presence of a solid barrier (natural landform or manmade) between a source of sound and a receiver that interrupts the direct line of sight between the two, thus reducing the sound level at the receiver compared to that in the absence of the barrier
ambient noise	All-encompassing noise associated with a given environment, usually a composite of sounds from many sources both far and near, often with no particular sound being dominant
annoyance	a feeling of displeasure in this case evoked by noise
attenuation	the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
audio frequency	any frequency of a sound wave that lies within the frequency limits of audibility of a healthy human ear, generally accepted as being from 20 Hz to 20,000 Hz
background noise	the noise level rarely fallen below in any given location over any given time period, often classed according to day-time, evening or night-time periods (for the majority of the population of the UK the lower limiting noise level is usually controlled by noise emanating from distant road, rail or air traffic)
dB	abbreviation for 'decibel'
dB(A)	abbreviation for the decibel level of a sound that has been A-weighted
decibel	the unit normally employed to measure the magnitude of sound
directivity	the property of a sound source that causes more sound to be radiated in one direction than another

Terminology	Description
equivalent continuous sound pressure level	the steady sound level which has the same energy as a time varying sound signal when averaged over the same time interval, T, denoted by $L_{Aeq,T}$
external noise level	the noise level, in decibels, measured outside a building
filter	a device for separating components of an acoustic signal on the basis of their frequencies
frequency	the number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (also known as the 'pitch' of a sound)
frequency analysis	the analysis of a sound into its frequency components
ground effects	the modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver
hertz	the unit normally employed to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
impulsive sound	a sound having all its energy concentrated in a very short time period
instantaneous sound pressure	at a given point in space and at a given instant in time, the difference between the instantaneous pressure and the mean atmospheric pressure
internal noise level	the noise level, in decibels, measured inside a building
L_{Aeq}	the abbreviation of the A-weighted equivalent continuous sound pressure level
L_{A10}	the abbreviation of the 10 percentile noise indicator, often used for the measurement of road traffic noise
L_{A90}	the abbreviation of the 90 percentile noise indicator, often used for the measurement of background noise
level	the general term used to describe a sound once it has been converted into decibels
loudness	the attribute of human auditory response in which sound may be ordered on a subjective scale that typically extends from barely audible to painfully loud

Terminology	Description
noise	<p>physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure.</p> <p>Subjectively: sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver</p>
noise emission	the noise emitted by a source of sound
noise immission	the noise to which a receiver is exposed
noise nuisance	an unlawful interference with a person's use or enjoyment of land, or of some right over, or in connection with it
octave band frequency analysis	a frequency analysis using a filter that is an octave wide (the upper limit of the filter's frequency band is exactly twice that of its lower frequency limit)
percentile exceeded sound level	the noise level exceeded for n% of the time over a given time period, T, denoted by $L_{An,T}$
receiver	a person or property exposed to the noise being considered
residual noise	the ambient noise that remains in the absence of the specific noise whose effects are being assessed
sound	<p>physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure</p> <p>subjectively: the sensation of hearing excited by the acoustic oscillations described above (see also 'noise')</p>
sound level meter	an instrument for measuring sound pressure level
sound pressure amplitude	the root mean square of the amplitude of the acoustic pressure fluctuations in a sound wave around the atmospheric mean pressure, usually measured in Pascals (Pa)
sound pressure level	a measure of the sound pressure at a point, in decibels
sound power level	the total sound power radiated by a source, in decibels
spectrum	a description of the amplitude of a sound as a function of frequency

Terminology	Description
Standardised wind speed	Values of wind speed at hub height corrected to a standardised height of ten metres using the same procedure as used in wind turbine emission testing
threshold of hearing	the lowest amplitude sound capable of evoking the sensation of hearing in the average healthy human ear (0.00002 Pa)
tone	the concentration of acoustic energy into a very narrow frequency range

Proposed Inis Cealtra Visitor Experience, Co. Clare.

APPENDIX 13.1

LIST OF RECORDED MONUMENTS ON INIS CEALTRA FROM HISTORIC ENVIRONMENT VIEWER, ARCHAEOLOGY.IE



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Inis Cealtra, or the Island Home of St. Camin. Benjamin Watkins 1863 Ulster Museum and Art Gallery

Appendix 13.1

List of Recorded Monuments on Iniscealtra from Historic Environment Viewer, archaeology.ie

82 Melvin Road, Dublin 6w. Phone 087 2651541, 087 2491102
Email: clairewalsh27@outlook.com alanrhayden@icloud.com
Directors: Claire Walsh & Alan Hayden VAT 6549543F



Figure 1. Screen grab of Historic Environment Viewer from archaeology.ie

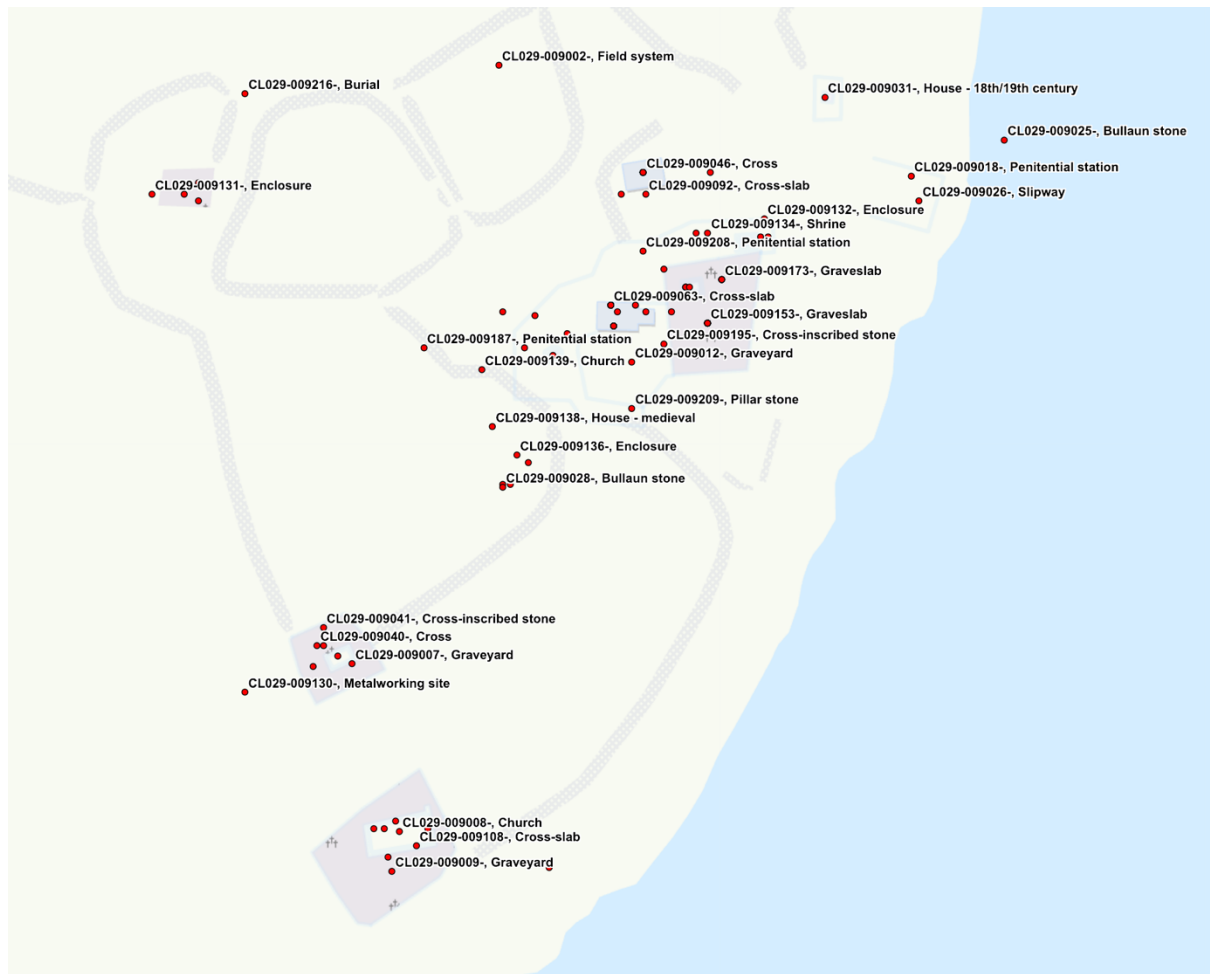


Figure 2. Detail of Historic Environment Viewer from archaeology.ie

SMR No ITM Easting ITM Northing Monument Class

This record was listed as 'Earthwork complex' in the RMP (1996). There are several subdivisions of the land around the monastic remains on the island of Inis Cealtra (Holy Island). Between St. Caimin's church (CL029-009011-) on the E side of the island and the D-shaped enclosure (CL029-009131-) centrally placed, there are a number of subrectangular areas defined by double banks or roadways. According to de Paor (2013, 45) rough drystone walls were erected to form small enclosures and these were linked by equally rough paved ways in a network which covered the monastic quadrant. These were essentially a layout for the performance of pilgrimage 'rounds' (although they also probably served for the formation of small tillage plots and paddocks). Pathways linking different sites for pilgrims began as early as the late 13th century but the main development was later continuing until the late 17th or possibly the 18th century. In the later phases a broad paved road (max. Wth 9m; int. H 0.2m; ext. H 1.5m) connected St. Caimin's Church (CL029-009011-) with St. Mary's (CL029-009008-). Another pathway (max. Wth 6.3m; H 0.15-0.8m) connects the northern tip of the island near one of the landing points with the main ecclesiastical complex. Excavation revealed that a bank-and-ditch system extending S to St. Brigid's church (CL029-009006-) from the central D-shaped enclosure (CL029-009131-) and the peripheral bank running into the S boundary of St Brigid's enclosure (max. Wth 2.7m; H 0.1-0.15m) belong to an early phase of activity on the island (ibid., 35). The feature extending S from St. Michael's to St. Brigid's has been radiocarbon dated to Cal AD 778-985 (UBA-27543). A late 8th to early 9th-century bronze pin was found in its primary fill. The secondary fill produced the radiocarbon dates confirming the chronology indicated by the pin (Seaver and O'Sullivan 2015, 12-13). Two separate features, a bank (max. Wth 5.1m; H 0.3-0.4m) and a fosse (max. Wth 5.1m; D 0.1-0.25m) extend W from the D-shaped enclosure forming a triangular area. There are traces of ridge and furrow cultivation throughout the island (Bing image <http://binged.it/1LSeFWo>; Accessed 8 July 2015). (Macalister 1916-17, 141-2) Iniscealtra is a national monument in state care, no. 5.

CL029-009002- 569814 685129 Field system

St. Michael's church was situated towards the centre of Inis Cealtra on Lough Derg within a small children's burial ground (CL029-009004-) which is itself within a possible ringfort (CL029-009131-). The lower courses of a very small mortared stone structure (ext. dims. 2.8m x 2.7m) oriented WNW-ESE were excavated by de Paor in 1972-3. He found it to be without foundations but it was paved internally with flags. Macalister had described a building of roughly coursed flat stones with a doorway at W (Wth 0.48m). A small fragment of moulded stone which may have been associated was found lying inside the building in 1916. De Paor established that this building was late within the chronology of activity in this area which spanned about AD 1500 to the late 19th century and was likely to have been constructed while the surrounding enclosure was in use for infant burial. This was one of the stations during pilgrimages and a large sandstone block (CL029-009052-) within the burial ground was used as a penitential station during the rounds. The area is much overgrown and only the penitential station is evident. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916, 117-18; de Paor 2013, 36-7)

CL029-009003- 569730 685096 Church

Situated towards the centre of Inis Cealtra (Holy Island) within a possible ringfort (CL029-009131-). A roughly square enclosure (max. dim. c. 15m) excavated in 1972-3. Prior to excavation it was defined by a low stony bank. Construction was found to have been in two phases, the first consisting of an earthen bank and fosse and later an unmortared stone wall. Some remains of stone paving were found running along the inside of the wall. The enclosure had been used as a burial ground, exclusively for infants, almost all new-born. A handful of quartz pebbles and a long stone pebble were deposited in most of the graves. Macalister noted an entrance (Wth 0.81m) in the middle of the S side with two jambstones on the E side and one on the W. A small cell or church (CL029-009003-) lay within the enclosure. A large sandstone block (CL029-009052-) within the burial ground was used as a penitential station during pilgrimage rounds. The area is much overgrown and only the penitential stations is evident. (Macalister 1916, 117-18; de Paor 1973; de Paor 1997; de Paor 2013, 36-7)

CL029-009004- 569726 685093 Graveyard

Situated within a subrectangular enclosure (CL029-009007-) c. 90m SW of the Round Tower (CL029-009010-) on Inis Cealtra (Holy Island) in Lough Derg. Named 'St Michael's Church and Garden' on the 1840 OS 6-inch map, 'Baptism Church' on the 1920 OS 6-inch map and called 'St Brigid's church' by Macalister (1916). A small, ruined, single-celled church (ext. dims. 8.5m by 5m) with a Romanesque doorway (Wth 0.7m; H 1.85m) at W. There are two deeply splayed windows one in the E wall and one on the S wall near the altar. The E window is widely splayed (Wth 0.72m; H 0.7m; sill H 1.2m) and has been robbed out. The window in the S wall also has a wide interior splay (Wth 0.92m; surviving H 0.8m; sill H 0.95m) and the window itself was 0.15m wide. Excavation took place here from 1970 to 1972 revealing much collapsed masonry. The roof was slated and there was evidence that slates, brought from elsewhere, were trimmed in situ. The church was built about the middle of the 12th century but was abandoned as a place of worship about the beginning of the 13th century. The interior of the church was used for burial, almost certainly in the 13th century and perhaps later, with at least twenty bodies being deposited, two of which were of women in childbirth. The burials were all extended, all but one lying E-W. The doorway and W gable had fallen by the early 19th century but these were rebuilt by the Board of Works in 1879-80 with some small irregularities. For a time in the 19th century the building was used to house animals. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 119-22; De Paor 1970; 1971; 2013, 28, 31-6)

CL029-009006- 569769 684964 Church

A subrectangular enclosure (21m E-W; 20m N-S) on a S-facing slope surrounding St. Brigid's church (CL029-009006-) and named 'Graveyard' on the 1920 OS 6-inch map. Defined by a roughly coursed, mortared wall (at W: int. H 0.66m; Wth 0.83m; ext. H 1m) with a round-headed entrance (Wth 0.73m; H 1.73m) midway along the S wall with a simple moulding inside. Before excavation in 1970-71 it was defined at W, N and E by an earthen bank with some stone. Excavation took place here from 1970 to 1972 and revealed that the enclosure had been repaired and rebuilt several times with a drystone wall forming the last in a series of enclosing features. Paving inside the wall was associated with the making of stations or rounds. No burials were found within the enclosure. A deep V-shaped fosse along the N sector and a broad shallow fosse at E were considered to be features of an early phase of activity on the island. A hazel sample from the fill of the enclosure fosse at N yielded radiocarbon dates of Cal AD 992-1150 (UBA-27540)(Seaver and O'Sullivan 2015, 12-13, 33). Fragments of two bone combs from the fill date to AD c. 1050-1125 (ibid., 13). The building of St. Mary's church (CL029-009008-) c. 30m to the S very early in the 13th century involved the construction of the mortared stone wall which now forms the S boundary of the enclosure. A copper-working furnace (CL029-009128-) was found within the enclosure just W of the doorway of St. Brigid's church and there was evidence of iron-working (CL029-009129-) within the enclosure immediately N of the church. Further metalworking evidence (CL019-009130-) was revealed outside the enclosure to the W. Iniscealtra is a national monument in state care, no. 5. (De Paor 1970; 1971; 2013, 28, 31-6)

CL029-009007- 569773 684962 Graveyard

Situated on a S-facing slope within a graveyard (CL029-009009-) some 43m S of St. Brigid's church (CL029-009006-) on Inis Cealtra in Lough Derg. St. Mary's is the largest (ext. dims. 18.57 by 8.72m) and most southerly church on the island, originally constructed in the late 12th/early 13th century but used as a medieval parish church and much reconstructed subsequently. It has a W doorway (Wth 1.07m; H 2m) with a slightly pointed arch and a simple external moulding of early 13th-century date. Two other later doorways, one in the S wall (Wth 1.42m; H 2.32m) 5.3m from the W gable and one in the N wall (Wth 1.12m; H 1.84m), are now blocked up. The N doorway is only visible externally. The church was not well lit. There were only two windows, a tall single lancet in the E end (Wth 0.23m, remaining H 1.2m with a deeply splayed embrasure) and another single round-headed lancet on the S wall to light the altar. This was also deeply splayed (int. H 2.5m; Wth 1.5m). There is an unusual offset in the S wall starting just W of the window and extending along the length of the church but not reaching the top of the wall. The wall may have been thickened at some stage by adding a new face to the inside. There are two aumbries, one in the S wall near the E corner and one in the N wall near the E end. The head of an ogee-headed window is mounted inside the upper portion of the blocked-up doorway on the S wall and the lower part of a window is placed on the ground beneath. It is not clear where these belonged originally. There is a buttress against the N wall externally with a water channel or slop-stone pierced through. An elaborately carved altar at the E end formed part of an O'Brien wall monument (CL029-009123-) the upper portion of which is mounted on the S wall. Four cross-slabs (CL029-009071-, CL029-009100-, CL029-009108-, CL029-009202-) are mounted on the walls in the interior. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916, 130-31; de Paor 2013, 28)

CL029-009008- 569786 684915 Church

Situated on a low hill 12m SW of St. Caimin's church (CL029-009011-) on Inis Cealtra. A well-built round tower with a flat top. The stonework is well coursed with exceptionally large stones in the base. The wall is offset 0.1m at the base 0.3m above ground. Excavations in 1976 revealed this course to be 0.4m deep with a thin layer of small stones and natural rock below that (Barrow 1985, 61). The diameter at base is 4.58m and at the doorway at ENE it is 4.5m. The interior is dug out to 0.6m above the external offset. Large stones project from the wall corresponding to the large stones in the external wall. There is a rough offset for a floor 2m above the ground. The second floor is formed by a number of large corbels and flagstones projecting from the wall and higher up there are three more offsets. The door at ENE is round-headed (Wth 0.64m at base; H 1.6m to soffit; T 1.05m). The top of the door is cut out of three stones carried right through the wall and the sill, likewise, is a single slab. A large, finely dressed, angle-headed window faces N above the second floor level and three more square-headed windows face ENE, SSW and NW in ascending order. The excavation revealed careful preparation in advance of construction. A large oval disc of puddled clay studded with small boulders and stones was laid down, ringed by small drain-trenches. A short sequence of post-holes concentric with the tower at NW were interpreted as marking the end of a stairway which rose to the sill of the door. A number of burials were found between the round tower and St. Caimin's (CL029-009140-). Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 137-9; Barrow 1979, 61-3; De Paor 2013, 41-2)

CL029-009010- 569829 685048 Round tower

CL029-009011- 569847 685060 Church

On the E side of Inis Cealtra (Holy Island) and at the centre of the monastic complex, St Caimin's church is a building of several periods of construction. It was originally a single-celled building (int. dims. 9.22m E-W by 6.1m N-S) with corner antae, in roughly coursed, mortared stone, no doubt with a trabeate doorway (de Paor 2013, 27). The remaining more westerly window in the S wall (H 0.75m; Wth at base 0.4m; Wth at top 0.32m) is of the first period of building which is most probably of 10th century date. It has a flat lintel and inclined sides with an external reveal and the interior sill is built up in steps. There is also a round headed window with external moulding in the S wall closer to the chancel (H 0.7m; Wth at base 0.28m; Wth at top 0.27m). This also has a splayed embrasure but the sill is plunging rather than stepped. A curious small triangular window formed of three stones occupies the W gable high above the door. While this may be original it is not paralleled at other early churches (Ó Carragáin 2010, 309). A Romanesque doorway was later made in the W wall; the present doorway of four orders was inserted during the excavations in the 1970's replacing a door with three orders built in 1879. A Romanesque chancel was inserted between the E antae. The chancel (int. dims. 4.4m x 3.8m), sometimes referred to as St. Colum's church, is neatly built with well squared stones and it is not bonded to the nave. Where the E wall of St. Caimin's was broken through a chancel arch was inserted with three orders facing the nave and two facing the chancel. Ornament was confined to the rounded piers which are adorned with capitals and there is a grotesque head on the keystone facing the nave. The side walls of the chancel are of ashlar masonry and there is one remaining round-headed window in the S wall (H 0.63m; Wth 0.15m) with an external rebate and internal splay. There may originally have been an E window. The altar as restored is a block of masonry with bowtell mouldings at the angles capped with floral capitals. Ó Carragáin (ibid., 197) notes that monumental altars of well-dressed stone are very rare with only three convincing examples published - this one and two others also in Clare (Dysert O'Dea and Rath). There is a small square aumbry on the S wall close to the chancel arch. A string course extends along the N and S sides of the chancel just below the roof level. At some stage a bell-cote was contrived in the E gable and the building was extensively restored by the Board of Works in 1879-80. The nave was reroofed in the 1990s by the OPW. A large number of crosses and cross-slabs are housed in the church. A graveyard (CL029-009012-) lies to the S and another graveyard, known as the 'saint's

Situated on a gentle S-facing slope on the E side of Inis Cealtra S of St. Caimin's church (CL029-009011-). An irregularly shaped graveyard (c. 25m E-W; c. 27m N-S) defined by a low mortared wall (av. int. H 0.65m; Wth 0.4m; ext. H 1.1m) of roughly coursed rectangular blocks, cross-capped with rough slabs. There is an entrance gate (Wth 1.26m) at the SW corner of St. Caimin's church where it meets the graveyard wall. A small stile at W (Wth 0.28m) is splayed internally and externally. The E wall is shared with the 'Saint's graveyard' (CL029-009030-). The headstones are mostly 20th century but a possible cross-inscribed stone (CL029-009195-) is erected at E just outside the entrance to the Saint's graveyard.

CL029-009012- 569851 685046 Graveyard

Situated c. 30m N of St. Caimin's Church (CL019-009011-) on Inis Cealtra and obscured by wooden fencing. A small subcircular stone (L 0.6m; Wth 0.56m; H 0.3m), almost totally moss-covered with a circular basin (diam. 0.35m; D 0.18m) filled with clay. This bullaun may have moved to different locations on the island at various stages. Dunraven (1877, 56) placed it at the W gable of St. Caimin's church and in 1984 it was noted at the N gable (McNamara 1984, 32, no. 3). McNamara also noted a 'round blue sandstone' weighing 5kg in the basin which is no longer present.

CL029-009013- 569848 685093 Bullaun stone

A wheeled high cross, the upper portion of which is mounted on the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra, 7.82m from the E end. The shaft is mounted on a cross-base 5m W of the round tower (CL029-009010-). Described by Macalister (1916-17, 150) as 'a large elaborate cross (H 6ft 3in [1.9m], arms 2ft 7.5in [0.8m] across, T 6in [0.15m]) broken into many pieces, restored with cement and fastened to the wall of the church... The cross has five bosses, one in each arm and one in the middle and these were decorated with basketwork... The background, confined within the heavy frame that surrounds the edge of the face, is covered with a minute interlacing pattern. On the dexter side ... the arm end bears a representation of Adam and Eve. On the sinister side is a key pattern; there was a figured panel on the arm-end on this side also, but it is broken, and only about half remains. The surviving part seems to bear a figure walking, holding a long staff, but the intention of the sculptor can no longer be recovered'. The shaft, which at that stage was with the top in the church, bore a plait. The base (H 1m) is oval in plan (1m x 0.5m) with its sides curved in outline and tapering to 0.55m at the top. Macalister (ibid., 147) described the socket as 1ft 2in by 9in (0.35m x 0.22m) with a depth of 9in (0.22m) and estimated that no cross on the island would fit it. The shaft of the cross was mounted on the base by the OPW at a later date. De Paor (2013, 44) states that the cross may be dated with some confidence to the ninth century. Iniscealtra is a national monument in state care, no. 5.

CL029-009014- 569821 685050 Cross - High cross

Situated in the N sector of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, this building is called 'Baptism Church' on the 1840 OS 6-inch map and 'Teampull na bhfear ngonta (in ruins)' on the 1920 OS 6-inch map. A ruined, rectangular, Romanesque structure (ext. dims. 5.8m E-W; 4.2m N-S; wall T 0.6m at S, 0.8m at W) of large, roughly coursed, squared blocks on a plinth (projecting 0.18m; H 0.2m). Squared quoins (0.11m x 0.11m) project 0.04m from each face at the corners and this squared feature continues along the base of the walls just above the plinth. The walls survive to a maximum height of 1.85m at W. There is no evident entrance. A window at W had an internal splay but has been robbed out (Wth 0.6m; H 1.5m). The lower courses of an ope survive at S near the W gable (Wth 0.66m; H 0.86m). Another ope at the E end of the N wall (Wth 0.8m; H 0.3m) has an external splay (ext. Wth 1.18m). None of the opes go to ground level. Macalister (1916-17, 136) interprets all three opes as entrances. An altar (Wth 1.5m; projecting 0.5m) occupies the E end and is capped with large broken flags (1.75m x 0.8m). A wall extends for 3.06m from the NE corner and is butted to the E wall. The building was extensively reconstructed, probably around 1700 (De Paor 2013, 28). According to Ó Carragáin (2010, 223) this is a mortuary chapel used for the burial of particular classes of people. Iniscealtra is a national monument in state care, no. 5.

CL029-009015- 569867 685067 Church

Situated in the SW corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A cross-base (L 0.81m; Wth 1.27m; H 0.27m) trapezoidal in shape and split through the socket into two pieces. Only the top few centimetres are shaped which according to Okasha and Forsyth (2001, 48) suggests that it was intended to be embedded in the ground. The upper surface is dressed with a groove forming a moulding around the perimeter and the SW corner has been chamfered. A worn inscription, in Irish, in one horizontal line is set along the W (longest) side and reads: '+ILAD IDECHENBOIR' (+Tomb of the ten persons). The cross-base stands NE of the centre of an almost square area (ext. L 2.4m N-S; Wth 2.3m) defined by a low kerb of thin upright stones. Some packing stones and other stones protruding from the ground may be all that remains of what Macalister (1916-17, 147) described as 'what seems to be a low cairn, covered with earth, and grass-grown'. The identity of the people buried here is not known. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 146-7; Okasha and Forsyth 2001, 47-50)

CL029-009016- 569869 685048 Cross

Listed as 'Potential site - name' in the RMP (1996) based on the OS map designation. Situated on a narrow shelf on an E-facing slope immediately NE of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra and standing at one time in a circular enclosure (CL029-009132-). Although named 'Confessional' on the OS 6-inch map it is not clear that this structure had a penitential use. A small ruined building (ext. dims. 3.1m E-W; 2.45m N-S) built of roughly coursed mortared walls surviving to 1.45m in height (max. T 0.65m). There is a plinth of different widths all around but widest at N (0.48m; H 0.25m) and there is stone paving at E and S. A doorway at E (Wth 0.57m) leads into the interior which is divided by two inclined flat standing stones. Two inclined square blocks occupy the corners at the W end of the building. These four stones occupy most of the floor space of the building. Excavation was conducted on this building and the surrounding area in the early 1970s. The upright stones in the building surrounded 'a shallow cist-like construction of limestone flags' (De Paor 2013, 37) and the 'confessional' was shown in its present form to date to around AD 1700. It had been rebuilt several times. This stone building appears to have replaced an earlier timber structure or shrine to the W (CL029-009134-) that was itself rebuilt several times. It may have been used as a reliquary. A recumbent cross-slab with a slot for an upright slab to the E were aligned with the confessional and the style suggests a tenth or eleventh-century date. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 132)

CL029-009017- 569883 685080 Building

Named 'Station' on the 1920 OS 6-inch map and listed as 'Potential site - name' in the RMP (1996). This is described by Macalister (1916-17, 139) as a 'carn' of stones at the inner end of a 'landing stage' (CL029-009026-). This area as indicated on the OS map is completely overgrown and inaccessible.

CL029-009018- 569929 685098 Penitential statio

Situated in a very overgrown area at the N end of Inis Cealtra c. 50m from the N shore. A bullaun stone, not fully accessible (c. 0.7m NE-SW x 1.2m NW-SE; H at front 0.22m) with a circular basin (diam. 0.5m; D 0.16m), broken at the SE end. Described (Macalister 1916-17, 143-4), citing a letter from a Mr. Hibbert, as 'sandstone, with occasional small, rounded, quartz pebbles in it; undoubtedly it has been shaped [to a hexagonal form]. The flat faces and angles are too clean and sharp not to have been worked. There is a lump on one of the angles which is the only portion not cut away. The bottom is shouldered off all round, so far as I could feel.'

CL029-009019- 569817 685257 Bullaun stone

A bullaun stone is indicated on the 1920 OS 6-inch map at ITM 569762, 685337 on Inis Cealtra. It is described by Macalister (1916-17, 143) as a stone (2ft 7in [0.78m] by 1ft 9in [0.53m] by 1ft 5in [0.43m]) with an oval depression (1ft 5in [0.43m] by 1ft [0.3m]; D 5in [0.12m]) 'towards the north shore of the island'. On inspection on 21 July 2015 the area was found to be very overgrown and the bullaun stone was not located.

CL029-009020- 569762 685337 Bullaun stone

Situated under some bushes in a very overgrown area at the NE corner of Inis Cealtra and c. 100m N of the 'Confessional' (CL029-009017-). This bullaun stone (Wth N-S 1.1m; traceable Wth E-W 0.8m; traceable H 0.3m) has an oval basin (0.46m N-S; 0.35m E-W) and is completely ivy-covered. (Macalister 1916-17, 143, no. 4; McNamara 1984, 32)

CL029-009024- 569936 685177 Bullaun stone

Situated in the water c. 10m from the E shore of Inis Cealtra. Weirs associated with the Ardnacrusha power station as part of the Shannon Hydro-electric scheme caused the level of the lake to rise and the shoreline to be flooded. A number of rocks are partially submerged in the area and this is the largest (1.5m x 0.85m; H 0.8m), it is subrectangular in plan with a straight NE side. The top of the boulder is very uneven and there is one circular basin (diam. 0.37m; D 0.12m at E and 0.07m at the lower W side) on the SW side. (Macalister 1916-17, 143; McNamara 1984, 32)

CL029-009025- 569955 685108 Bullaun stone

Indicated and named 'Landing stage' on the 1920 OS 6-inch map and listed in the RMP (1996) as 'Potential site - name'. Described by Macalister (1916-17, 139) as a boat-pier of large undressed blocks of stone, rectangular in plan (L 49ft (14.9m); H towards the lake edge 3ft3in (0.99m)). A possible penitential station (CL029-009018-) was apparently on the inner end of this landing stage. This area as indicated on the OS map is completely overgrown and inaccessible.

CL029-009026- 569931 685091 Slipway

One of two bullaun stones located c. 35m SSW of the round tower (CL029-009010-) on Inis Cealtra. The other bullaun stone (CL029-009029-) is 0.9m to the N. A fairly flat rectangular stone (L 1.9m NNW-SSE; Wth 0.9m) is exposed at ground level and contains a circular water-filled depression (diam. 0.61m; D 0.21m) at the NNW end. Portion of the side of the depression at NW is broken away. A 4m square cutting around the adjacent bullaun was excavated in 1977 (de Paor 2013, 42-3). Numerous finds from the upper layers included whetstones, knife-blades, nails, clay pipe fragments, burnt bone, mortar, slag and chert chippings. An extension to this cutting in 1979 revealed this second bullaun. The soil near the two bullauns was heavily mottled with charcoal flecks and burnt material. A part of a stone pestle was also found which may have been used in the hollows of the bullauns. McNamara (1984, 31-2) described the two adjacent boulders as very similar in shape with depressions in similar locations on both.

CL029-009028- 569815 685011 Bullaun stone

One of two bullaun stones located c. 35m SSW of the round tower (CL029-009010-) on Inis Cealtra. The other bullaun stone (CL029-009029-) is 0.9m to the S. A low, roughly rectangular, limestone boulder (max. H at S 0.33m; L 1.8m NNW-SSE; Wth 1.1m) with rounded ends and a slightly convex upper surface. A subcircular depression (diam. 0.52m x 0.48m, D 0.24m) lies slightly S of centre. The depression is deep in relation to the height of the stone. A 4m square cutting around this bullaun was excavated in 1977 (de Paor 2013, 42-3). Numerous finds from the upper layers included whetstones, knife-blades, nails, clay pipe fragments, burnt bone, mortar, slag and chert chippings. An extension to this cutting in 1979 revealed the second bullaun (CL029-009028-). The soil near the two bullauns was heavily mottled with charcoal flecks and burnt material. A part of a stone pestle was also found which may have been used in the hollows of the bullauns. McNamara (1984, 31-2) described the two adjacent boulders as very similar in shape with depressions in similar locations on both.

CL029-009029- 569817 685012 Bullaun stone

Situated on an E-facing slope immediately E of St. Caimin's church (CL029-009011-) on Inis Cealtra. This is known as the 'Saint's graveyard' and according to de Paor (2013, 44) it was laid out and walled in the twelfth century or just before it. A trapezoidal area (30m N-S at wider end; 25m E-W) defined by a well-built, mortared, roughly coursed wall with occasional large blocks. The wall is highest at W (int. H 1.3m; ext. H 0.8m; T 0.8m) and lowest at E (int. H 0.5m; ext. H 1m; T 0.55m) and is cross-capped with rough slabs along the N side and at the N end of the W side. The E wall acts as a retaining wall as there is a very steep slope on the exterior in an area that may have been an orchard. There is a round-headed entrance feature on the W wall (Wth 0.98m; H 1.9m; T 0.7m). According to Macalister (1916-17, 142) the entrance is old but the round-headed top has been repaired with one of the voussoirs having been borrowed from the doorway into the enclosure at St. Brigid's church (CL029-009006-). The walls were repaired and coped by the Board of Works. A small church, Teampull na bhfear ngonta (CL029-009015-) is in the NW quadrant of the graveyard and there are a large number of recumbent graveslabs and cross-slabs in their original locations. During excavations on the island in the 1970s the growth around these slabs was cut back and the slabs were drawn but not disturbed (de Paor, SMR file). A small number of modern burials are also present. This graveyard and all of the monuments on the island are national monuments in State care.

CL029-009030- 569872 685057 Graveyard

Near the E shore of Inis Cealtra in Lough Derg c. 40m NE of the 'Saint's Graveyard' (CL029-009030-). The foundations of a small two-roomed building excavated by de Paor in 1970 (Licence no. E000180, report 2, Area 2, 49-51). Described by Macalister (1916-17, 140) as a structure (34ft (10.3m) by 18ft (5.4m)) of drystone masonry, very roughly built (wall T 2ft 6in (0.76m); H 3ft (0.91m)) with a central chimney and back-to-back fireplaces. In spite of being cleared out by the Board of Works in 1879-80 it was clear that the floor had sloped steeply. The interior of the cottage and a small area around it was excavated. Finds were few and seemed to relate to the occupation of the building. Two fragments of querns were found inside, one to the W of the fireplace and one near the SE corner. A whetstone was found E of the chimney. Once the building had fallen into ruin it was used as a rubbish dump. This was referred to as a church at one time but that may have been in an effort to increase the number of churches on the island to seven (Macalister 1916-17, 140-41). Macalister also suggests that this is the 'one house' mentioned in an early 17th-century report by a Bishop Rider but on the basis of the few finds from excavation de Paor estimates a mid-18th century date. On inspection in 2016 this area was found to be completely overgrown and inaccessible. (de Paor 2013, 28, 30-31)

CL029-009031- 569905 685120 House - 18th/19t

Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a cross-slab that according to Macalister (1916-17, 151, no. 21, and plate XVI) was on the N wall of the chancel of St. Caimin's church (CL029-009011-), on Inis Cealtra (Holy Island), Co. Clare. It was noted by de Paor in the 1970s (SMR file) on the S wall of the nave of the church. It is now in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151006-). Macalister (ibid.) described the slab as of 'Eighth-century type'... 'A stone, measuring 1 foot 7 inches by 1 foot 1 inch by 3 inches [0.48m by 0.33m by 0.07m]. Within a circle of two lines, a cross formed of four arcs of circles, interlacing at the intersection; the ends of the arcs are terminated with a spiral treatment. In the cantons are triskeles of one line.'

CL029-009032- 569855 685060 Cross-slab

Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a recumbent cross-slab in the Saint's Graveyard (CL029-009030-) on Inis Cealtra (Holy Island), Co. Clare. It is visible still in situ in a photograph from de Paor's excavation report (1997) and was indicated as such on his plan (SMR file). It was exhibited in Mountshannon in August 1982 and was then placed for safe keeping in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151007-). The slab (H 1.6m; Wth 0.59m; T 0.06m) has a ringed Latin cross in false relief. All four terminals have semicircular expansions, that of the shaft dividing into two petals. There is four-pointed recess at the centre of the cross. There are the outlines of two shod feet on the right hand side, the right foot above the arm of the cross and the left foot below it, both pointing to the top. Macalister suggests that this may indicate that the person commemorated was a pilgrim. The inscription which is incised in two lines above the head of the cross and inverted reads 'COSCRACH LAIGNECH' (Coscrach the Leinsterman). The form of this cross is unique at Inis Cealtra and is dated by Macalister to the 10th century. (Macalister 1916-17, 153, no. 31, and plate XX; Okasha and Forsyth 2001, 58-61)

CL029-009033- 569862 685060 Cross-slab

Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a sundial that according to Macalister (1916-17, 167, no. 92, and plate XXIV) was on the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra (Holy Island), Co. Clare. It is now in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151008-) (L 1.46m; Wth at top 0.4m; Wth at base 0.36m; T 0.1m). Macalister (ibid.) described the sundial as a slab with a hole for the gnomon, pierced through the stone, and a semicircle with five rays below it.'

CL029-009034- 569846 685056 Sundial

Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a cross-slab that according to Macalister (1916-17, 158, no. 63, and plate XIX) was on the S wall of St. Caimin's church (CL029-009011-), on Inis Cealtra (Holy Island), Co. Clare. It was exhibited in Mountshannon in August 1982 and was then placed for safe keeping in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151009-). The slab (H 0.96m; Wth 0.38m; T 0.06m) is irregular in shape and well-preserved. The face is dressed and deeply incised with an outline Latin cross hollowed at the angles and resting on a trapezoidal base. An inscription in two lines is incised above the cross and inverted and it reads 'ORDOMAEL PATRAIC' (with the OR overlined). It was dated by Macalister (ibid.) to the 12th century. (Okasha and Forsyth 2001, 83-5)

CL029-009035- 569846 685056 Cross-slab

This record is for the original location of the arms and top of a small highly decorated cross found on Inis Cealtra. Now in Clare Museum, Ennis. For present location and details see CL033-183-----.

CL029-009040- 569763 684967 Cross

This record is for the original location of a sandstone gravemarker (Wth c. 0.3m; H 0.26m) with incised Chi-Rho cross (early 7th century) from the collapse of the late wall near St Brigid's church, Inis Cealtra (CL029-009006-) (de Paor 2013, 35, 68). On display in Clare Museum, Ennis (see CL033-185----- for present location and details).

CL029-009041- 569765 684972 Cross-inscribed st

This stone was noted by Macalister (1916-17, 145, no. 2) at the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a tall sandstone block (H 0.31m; Wth 0.24m) with deep natural striations. A wide, deep, rectangular socket (0.16m x 0.09m) is centrally placed.

CL029-009043- 569854 685099 Cross

This stone was noted by Macalister (1916-17, 145, no. 3) at the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a sandstone block (H 0.23m; Wth 0.37m at the base narrowing to 0.28m at the top) with a rectangular socket (0.2m x 0.1m; D 0.06m). There is some evidence of incised decoration on all faces.

CL029-009044- 569854 685099 Cross

This stone was noted by Macalister (1916-17, 145, no. 4) at the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a sandstone block, roughly trapezoidal in shape (H 0.26m; Wth 0.3m at the base narrowing to 0.18m at the top) with a rectangular socket (0.12m x 0.08m; D 0.02m).

CL029-009045- 569854 685099 Cross

This stone was noted by Macalister (1916-17, 145, no. 5) at the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a sandstone block, roughly trapezoidal in shape (H 0.24m; Wth 0.32m at the base narrowing to 0.23m at the top) with a rectangular socket (0.13m x 0.08m; D 0.05m). The socket has vertical sides and a flat base. A possible incised line is evident on one face.

CL029-009046- 569854 685099 Cross

This stone was noted by Macalister (1916-17, 145, no. 6) at the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a tall sandstone block (H 0.34m; Wth 0.22m at base tapering to 0.17m at top). A rectangular socket (0.09m x 0.06m; D 0.05m) with sloping sides is at the top.

CL029-009047- 569854 685099 Cross

This stone was noted by Macalister (1916-17, 145, no. 6) at the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a conical sandstone block (H 0.34m; diam. 0.36m at base narrowing to 0.19m at the top) with a rectangular socket (0.08m x 0.05m; D 0.07m) off-centre at the top. The top of the stone is broken and so the socket is incomplete.

CL029-009049- 569854 685099 Cross

Situated 3.6m from the E door of the 'Confessional' (CL029-009017-) on Inis Cealtra. A cross-base described by Macalister (1916-17, 145, no. 9) as a stone 0.48m [1ft7in] high with a socket 0.35m [1ft 2in] square by 0.12m [5in] deep.

CL029-009050- 569889 685081 Cross

Located at the head of a cross-slab (CL029-009111-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A cross-base (H 0.2m) with a rectangular base (L 0.3m; Wth 0.25m) tapering gently to a square upper surface (L 0.2m; Wth 0.2m) which contains a shallow rectangular mortise (L 0.12m; Wth 9cm; D 0.05cm). (Macalister 1916-17, 146, no. 10)

CL029-009051- 569872 685057 Cross

Situated in a small clearing in a very overgrown area close to the site of St. Michael's church (CL029-009004-) on Inis Cealtra. A flat boulder with a smooth, trapezoidal shaped, upper face (max. L 1.25m; max. Wth at E 1m; Wth at W 0.43m; traceable H 0.38m). According to the OS Letters (O'Flanagan 1927, vol. 2, 228), pilgrims went '7 times round a large flag stone [at St. Michael's garden]....on which they finally (i.e. after having gone round it 7 times) impressed kisses.' The way into the clearing had been recently opened as there had been a gathering on the island for Mass. A stone step (Wth 1.65m) adjacent to the stone may have been associated with St. Michael's church.

CL029-009052- 569730 685091 Penitential statio

Located 9.16m from the S wall and 9.57m from the E wall of the Saint's graveyard (CL029-009030-) on Inis Cealtra (a short distance from the location indicated on Macalister's plan of the graveyard (1916-17, 147, no. 13 and Pl. XV) and in a different orientation). A stone (L 1.2m; Wth 0.44m) with a large socket (L 0.94m; Wth 0.15m; D 0.12m), possibly a cross-base. There is a slight dip on the E side of the socket.

CL029-009053- 569872 685057 Cross

Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) and 5.02m from the W gable. Described by Macalister (1916-17, 147, no. 14) as a slab cut into the shape of a cross (H 1.86m [6ft 1.5in]; T 0.07m [2.75in]), hollowed at the angles but without a surrounding wheel. There is no ornamentation except for a groove following the line of the edge. The left arm is partially broken, the original breadth was 0.95m [3ft 1.5in]). Two square panels one on each side at the base each contain a saltire cross in false relief.

CL029-009054- 569845 685062 Cross

Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) and 6.42m from the W gable. Described by Macalister (1916-17, 147, no. 14 and Pl. XVII) as an important cross, once smashed to pieces but collected and cemented together by the Board of Works. This highly ornamented cross (H 1.59m; Wth across arms 0.97m; T 0.08m) was carved from a large slab and, similar to CL029-009054-, it has hollowed angles, no surrounding wheel and two rectangular panels at the base on either side of the shaft. Most of the left side panel at the base is missing. A roll moulding extends all around the outline of the cross and the arms and shaft had elaborate interlace that is now very faded. All that can be seen on the left side-panel are two boss-like objects, but on the right panel there is a quadruped, perhaps a unicorn, with the leg of a devoured human protruding from its mouth (Harbison 1992, 98, and pls 317 and 1015). On both sides there is text starting at the outer edge of the underside of the arm and reading down along the shaft. The right-hand text reads 'OR DOARDSE[N]OIR HERENN I DO CATHAS[A]' and the left-hand text reads 'OR DO TH[-O] DORIGNIICROI-' (Okasha and Forsyth 2001, 52). (Okasha and Forsyth 2001, 50-56)

CL029-009055- 569845 685062 Cross

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Located on the N wall of the nave of St. Caimin's church (CL029-009011-) and 8.85m from the W gable. Described by Macalister (1916-17, 149-50, no. 16) as a small wheeled cross with the openings between the wheel and the cross not pierced through. Macalister gives the dimensions as H 0.86m [2ft 10in]; Wth at base 0.35m [1ft 2in]; T at base 0.17m [7in] tapering to 0.08m [3.5in]. The cross is mounted on some smaller stones at the base.

CL029-009056- 569845 685062 Cross

Located on the S wall of the nave of St. Caimin's church (CL029-009011-) and 3.27m from the E end. A sandstone slab noted by Macalister (1916-17, 151, no. 18) as of 'Eighth-century type' and described as a stone (0.39m [1ft 3.5in] by 0.44m [1ft 5.5in] by 0.06m [2.5in]) bearing a Latin cross of one line with forked ends. The ends expand at the upper and lower ends and contract at the side ends.

CL029-009057- 569846 685056 Cross-slab

Cemented to the S wall of the nave of St. Caimin's church (CL029-009011-) and 3.75m from the E end. Noted by Macalister (1916-17, 151, no. 19) as of 'eighth-century type' and described as a stone (0.45m [1ft 6in] by 0.41m [1ft 4.5in] by 0.07m [3in]) bearing a plain one-line Greek cross within a circle. The whole of the circle is recessed about 0.006m [$\frac{1}{4}$ in] beneath the surface of the stone.

CL029-009058- 569846 685056 Cross-slab

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Cemented to the S wall of the nave of St. Caimin's church (CL029-009011-) and 1.6m from the E end. A sandstone slab (H 0.67m; Wth 0.47m; T 0.09m) noted by Macalister (1916-17, 151, no. 20) as 'of eighth-century type' and described as 'a stone bearing a Greek cross of four lines within a square of two lines; four-line diagonals are stopped by two-line circles in the cantons of the cross. The angles of the cross are hollowed and all joints are mitred.' There is an inscription in one horizontal line, divided between the two upper quadrants of the cross. It is in half-uncial script and reads 'MUIR[-]A[I]TH'. If the penultimate letter were a C rather than a T, then the text could be a form of the name 'Muiredach'. According to Okasha and Forsyth (2001, 95-6) this stone was first recorded in 1880 when it was in the graveyard but not in situ and it was in St. Caimin's church when Macalister saw it but he seems not to have noticed the text. (Okasha and Forsyth 2001, 95-7)

CL029-009059- 569846 685056 Cross-slab

Located on the ground (loose) against the S wall of the nave of St. Caimin's church (CL029-009011-) and 0.43m from the E end. Noted by Macalister (1916-17, 152, no. 22) as of 'eighth-century type' and described as a 'stone 1ft 5in (0.43m) by 1ft 7in (0.48m) by 2in (0.05m), bearing a cross 'pattée' in a circle; ovals at the ends of the arms of the cross, and trefoils in the cantons.'

CL029-009060- 569846 685056 Cross-slab

Located on the ground (loose) against the N wall of the nave of St. Caimin's church (CL029-009011-) and 3.15m from the W gable. Noted by Macalister (1916-17, 152, no. 24) as of 'Eighth-century type' and described as a 'stone, 1ft 8in (0.5m) by 1ft 2in (0.35m) by 6in (0.15m). Cross of similar design to the last (CL029-009061-) (i.e. a cross 'pattée' in a circle), but interlacements in two of the cantons, and a leaf-pattern in the other two, instead of the trefoils.'

CL029-009062- 569845 685062 Cross-slab

Located on the ground (loose) against the N wall of the nave of St. Caimin's church (CL029-009011-) and 4.27m from the W gable. An irregularly shaped slab (L 0.53m; max. Wth 0.44m; T 0.09m) with a much worn elaborate cross framed by two lightly incised circles. Noted by Macalister (1916-17, 152, no. 25) as of 'eighth-century type' and described as having a concave surface with a cross similar to several others (CL029-009060-, CL029-009061- and CL029-009062-) but with trefoils on both arms and cantons. He noted that the design was very faint and worn with the lines being no broader than pencil scribings.

CL029-009063- 569845 685062 Cross-slab

Mounted on the S wall of the nave of St. Caimin's church (CL029-009011-) and 2.44m from the E end. A sandstone slab (H 0.39m; Wth 0.53m; T 0.05m) noted by Macalister (1916-17, 152, no. 27) as 'of eighth-century type' and described as 'a stone bearing a Greek cross in a square. There are small square expansions in the centres and at the ends of the arms. In the cantons are key-patterns of simple type, except in one where there is an interlacement derived from four triquetras.' One horizontal line of text in half-uncial script (now much deteriorated) is incised outside and to the right of the frame, just below the arm of the cross and it reads 'DERM-' followed by two or three more letters and is likely a form of the name 'Dermait'. This stone was first recorded in 1880 when it was in the graveyard but not in situ. (Okasha and Forsyth 2001, 97-9)

CL029-009064- 569846 685056 Cross-slab

Located 2.6m from the E door of the 'Confessional' (CL029-009017-) on Inis Cealtra. A socket for an upright slab extends across the slab at the head of the cross. Noted by Macalister (1916-17, 152, no. 28) as 'of ninth-century type' and described as 'a stone bearing a 'Celtic' cross in cavo rilievo [false relief].' Macalister also mentions that one 'Delany' remembered a slab standing in the socket, which he described as being about 1ft high. He could not remember if it was inscribed or ornamented in any way.

CL029-009065- 569887 685081 Cross-slab

Located against the S wall of the nave of St. Caimin's church (CL029-009011-) and 1m from the E end. Noted by Macalister (1916-17, 152-3, no. 29) as of 'tenth-century type' and described as 'a slab, measuring 3ft 9in (1.14m) by 2ft 6in (0.76m) bearing ...a Latin cross with circular expansion at the centre, having a spiral pattern...in the middle of the circle... The terminal expansions are semicircular and contain key-patterns of common type.' Macalister also notes that the cross is very similar to the Clonmacnoise type of this period and may have been produced by a Clonmacnoise artist. Apart from the flat decorated face, the slab is rough and unworked with an unusual shape, rounded at the sides and coming to a point at the top.

CL029-009066- 569846 685056 Cross-slab

Located against the S wall of the nave of St. Caimin's church (CL029-009011-) and 8.56m from the E end, this slab (H 0.96m; Wth 0.48m; T 0.06m) previously lay in the chancel of the church (Okasha and Forsyth 2001, 56). Noted by Macalister (1916-17, 153, no. 30) as of 'tenth-century type'. The slab is broken in two pieces and bears an incised Latin cross with squared expanded terminals and square expansions at the centre. There is a small dent on the lower part of the left terminal. An inscription is incised in one horizontal line above the head of the cross and upside down with respect to it. It reads 'OR DO MURCHAD'. The cross and inscription occupy the whole of the dressed face with the terminals reaching the edges. (Okasha and Forsyth 2001, 56-8)

CL029-009067- 569846 685056 Cross-slab

This graveslab is in the middle of a composite grave in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. This particular slab lies 3.05m from the N wall of the graveyard and 3.3m from the E wall of Teampul na bhFear nGonta (CL029-009015-). Noted by Macalister (1916-17, 154) as of 'twelfth-century type' the slab (L 1.45m; Wth 0.46m; T 0.06m) is broken into three large pieces with several smaller pieces missing. An inscription occurs on what is now the middle piece and it is incised in a single line along the long axis of the stone. The text is incomplete and reads 'OR DO MACCU'. This is the only inscribed stone on the island that contains no cross (Macalister *ibid.*). (Okasha and Forsyth 2001, 61-4)

CL029-009068- 569876 685069 Graveslab

Situated towards the centre of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (18.5m from the S wall and 9.9m from the W wall). Noted by Macalister (1916-17, 154, no. 33) as of 'twelfth-century type' and described as 'a slab, 3ft 1in (0.93m) by 1ft 2in (0.35m), apparently imperfect at both ends' with a plain Latin cross of two lines.

CL029-009069- 569872 685057 Cross-slab

Situated in the NE quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (4.6m from the N wall and 6.61m from the E wall). Noted by Macalister (1916-17, 154, no. 34) as of 'twelfth-century type' and described as 'a slab, measuring 4ft 6in (1.37m) by 1ft 6in (0.45m), with a plain Latin cross of two lines.'

CL029-009070- 569872 685057 Cross-slab

Erected against the N wall of the nave of St. Mary's church (CL029-009008-) on Inis Cealtra and 7.75m from the W gable. Noted by Macalister (1916-17, 154, no. 35) as of 'twelfth-century type' and described as 'a slab, 4ft 9in (1.44m) by 1ft 8in (0.5m), with a plain Latin cross of two lines, boldly cut.'

CL029-009071- 569785 684918 Cross-slab

Located against the N wall of the nave of St. Caimin's church (CL029-009011-) and 2.55m from the W gable. A trapezoidal shaped slab noted by Macalister (1916-17, 154, no. 36) as 'twelfth-century type' and described as '6ft (1.82m) by 2ft 3in (0.68m), tapering to 1ft 9in (0.53m) by 5in (0.12m) thick, bearing a plain Latin cross of two lines. There is a square hole cut above the head of the cross, 1 5/8 in deep (0.04m). The surface of the cross is very friable, and is much weathered; the cross can only just be traced, and will before long be entirely scaled away.' The roofing of St. Caimin's church has helped to halt the deterioration of the slab.

CL029-009072- 569845 685062 Cross-slab

Situated close to Teampul na bhFear nGonta (CL029-009015-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra 18.9m from the S wall and 10.6m from the W wall. A cross-slab noted by Macalister (1916-17, 154, no. 37) as a 'twelfth-century type' and described as 'a slab, now 3ft 5in (1.04m) by 1ft 7in (0.48m), but the bottom is broken away, carrying with it the lower end of the cross.' Macalister describes this slab as 'similar to the preceding' which is no. 36 (CL029-009072-) which has a plain Latin cross of two lines.

CL029-009073- 569872 685057 Cross-slab

Situated in the E side of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.23m from the N wall and 6.05m from the E wall). Noted by Macalister (1916-17, 154, no. 38) as of 'twelfth-century type' and described as 'a slab, 5ft 5in (1.65m) by 1ft 10in (0.55m); the long edges are rebated, the rebate being 5/8in (0.01m) deep and 2in (0.05m) broad. Plain Latin cross, ...much worn and flaked.' While the cross is no longer evident to the eye, faint traces of the uppermost arm and left arm of the cross were made out in a rubbing (pers. comm. Clíodhna O'Leary, 22 April 2016).

CL029-009074- 569872 685057 Cross-slab

Situated close to the entrance to the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (10.3m from the S wall and 2.9m from the W wall). Noted by Macalister (1916-17, 154, no. 39) as of 'twelfth-century type' and described as 'a slab, 5ft 4in (1.62m) by 1ft 6 1/2in (0.46m)...Plain Latin cross...left open at the bottom.'

CL029-009075- 569872 685057 Cross-slab

Situated close to the entrance to the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (14.3m from the S wall and 3m from the W wall). Noted by Macalister (1916-17, 155, no. 40) as of 'twelfth-century type' and described as 'a slab, 5ft 2in (1.57m) by 2ft (0.6m)...Latin cross, the middle flaked away, the bottom left open. The side lines are bent outward at right angles, and prolonged to reach the edges of the slab.'

CL029-009076- 569872 685057 Cross-slab

			<p>Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (8.93m from the N wall and 6.16m from the E wall). A cross-slab (L c. 1.93m; Wth 0.8m; T c. 0.07m) now in three pieces with some missing. Noted by Macalister (1916-17, 155, no. 41) as of 'twelfth-century type' with a Latin cross with rectangular expanding base, open at the bottom where it met the end of the slab. An incomplete inscription on the stem of the cross reading upwards reads 'OR DO CHELLACH'. The slab was defaced previous to Macalister's visit by being used as a table to mix mortar. (Okasha and Forsyth 2001, 65-7)</p>
CL029-009077-	569872	685057 Cross-slab	<p>Located against the S wall of the nave of St. Caimin's church (CL029-009011-) and 5.88m from the E end. Noted by Macalister (1916-17, 155, no. 42) as of 'twelfth-century type' and described as 'a slab 5ft 2in (1.57m) by 1ft 9 1/2in (0.54m) by 4 1/2in (0.11m). Plain Latin cross of two lines, with a base formed by oblique lines running downward from the lower corners of the stem. The surface of the slab is deeply scored with straight grooves; apparently it has been used at some time for sharpening tools.'</p>
CL029-009078-	569846	685056 Cross-slab	<p>Located in the SW corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (3.3m from the S wall and 2.1m from the W wall). A cross-slab noted by Macalister (1916-17, 155, no. 43) as of 'twelfth-century type' and described as a slab, 5ft 2in (1.57m) by 2ft 5in (0.73m), with a Latin cross in high relief, 3 1/2in (0.08m) above the background. This cross-slab is now much weathered.</p>
CL029-009079-	569872	685057 Cross-slab	

Immediately inside the entrance to the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (12.3m from the S wall and 2.8m from the W wall). A cross-slab noted by Macalister (1916-17, 155, no. 44) as of 'twelfth-century type' and described as a slab 5ft 1 1/2in (1.56m) by 1ft 9in (0.53m) with a plain Latin cross on a trapezoidal base with slightly hollowed sides and a groove on the base running parallel with its outline. The top of the base is in relief, sloping to the level of the background at the bottom.

CL029-009080- 569872 685057 Cross-slab

This graveslab lies immediately S of a composite grave in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 5.5m from the N wall of the graveyard and 3.3m from the E wall of Teampul na bhFear nGonta (CL029-009015-). Noted by Macalister (1916-17, 155, no. 45) as of 'twelfth-century type' the slab (L 1.55m; Wth 0.5m; T 0.08m) has a Latin cross in relief on a trapezoidal base with concave sides. At the E end of the slab, above the cross and of a piece with it, is a panel which extends the full width of the slab. This panel contains two lines of text in Irish, upside down in relation to the cross. The top right corner is now broken off and the start of the text is missing. It was complete, although still difficult to decipher, in 1916 when it read: 'OR DO CATHGAL'. The slab is exceptional in having the head of its cross (and the text) at the E end. (Okasha and Forsyth 2001, 67-9)

CL029-009081- 569872 685057 Cross-slab

Located in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (12.6m from the N wall and 4.06m from the E wall). A cross-slab noted by Macalister (1916-17, 156, no. 46) as of 'twelfth-century type' and described as a slab, 4ft 1in (1.24m) by 1ft 4 1/4in (0.41m), with three small crosses in a row at the upper end. In the middle is a Greek cross in relief. To the left is a Latin cross with a cross-shaped groove running over its surface and to the right is a Latin cross pattée, both in false relief.

CL029-009082- 569872 685057 Cross-slab

Mounted on the E wall of the nave of St. Caimin's church (CL029-009011-) on the return before the entrance into the chancel. Noted by Macalister (1916-17, 156, no. 47) as of 'twelfth-century type' and described as a slab measuring 3ft 1in (0.93m) by 1ft 1in (0.33m) by 1 3/4in (0.04m) with a Latin cross with the angles hollowed with circular cuttings and the base open. Portion of the top of the slab is now missing.

CL029-009083- 569852 685062 Cross-slab

Situated immediately W of Teampul na bhFear nGonta (CL029-009015-) in the Saint's Graveyard (CL029-009030-) on Inis Cealtra, 23.4m from the S wall and 3.9m from the W wall. Noted by Macalister (1916-17, 156, no. 48) as of 'twelfth-century type' and described as a slab measuring 5ft 4in (1.62m) by 2ft (0.6m) bearing a Latin cross with the angles hollowed by circular cuttings. A rectangular panel around the cross-head throws it into false relief.

CL029-009084- 569872 685057 Cross-slab

Situated close to the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (21.3m from the S wall and 1.9m from the W wall). Noted by Macalister (1916-17, 156, no. 49) as of 'twelfth-century type' and described as a slab measuring 3ft 3in (0.99m) by 1ft 10in (0.55m), with a Latin cross in low relief with the angles hollowed with circular cuttings. (de Paor drawing, SMR file)

CL029-009085- 569872 685057 Cross-slab

Situated in the SW quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (8.3m from the S wall and 2.5m from the W wall). Noted by Macalister (1916-17, 156, no. 50) as of 'twelfth-century type' and described as a slab measuring 5ft 6in (1.67m) by 2ft 6in (0.76m), with a Latin cross with hollowed angles and the lower shaft angled outwards to form a base. The slab is broken and the lower left portion is missing. (de Paor drawing, SMR file)

CL029-009086- 569872 685057 Cross-slab

			<p>Situated in the NE quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.52m from the N wall and 4.06m from the E wall). Noted by Macalister (1916-17, 156, no. 51) as of 'twelfth-century type' and described as a slab measuring 5ft 6in (1.67m) by 1ft 10in (0.55m), tapering down to 1ft 5in (0.43m), with a Latin cross with hollowed angles and the lower shaft angled outwards to form a base. A 2in (0.05m) rebate extends down the long sides and Macalister describes the slab as slightly hog-backed. (de Paor drawing, SMR file)</p>
CL029-009087-	569872	685057 Cross-slab	<p>Mounted against the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 6.62m from the E end. A cross-slab (L 1.19m; Wth 0.42m; T 0.16m) noted by Macalister (1916-17, 156, no. 52) as of 'twelfth-century type' with a Latin cross with hollowed angles and an expanding base. An inscription in two horizontal lines above the top of the cross and upside down with respect to it reads 'OR DOLAITH BERTACH'. The same name occurs on another cross-slab (CL029-009198-) in St. Caimin's church. (Okasha and Forsyth 2001, 69-71)</p>
CL029-009088-	569846	685056 Cross-slab	<p>Situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (14.3m from the S wall and 7.9m from the W wall). Noted by Macalister (1916-17, 156, no. 53) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 71-2) as a large recumbent cross-slab (H 0.91m; Wth 0.61m; T 0.04m) now broken and incomplete. The slab would have been c. 1.45m in length originally. All that remains is one large piece broken in two with an incised Latin cross with hollowed angles. Macalister (ibid., pl. XIX) shows the incised cross with an expanded base or platform with concave sides. There is an inscription, most of which is in a horizontal line across the top of the cross, with one letter inside the upper arm of the cross. The text is complete and reads: 'OR D.. INGANE'. (Okasha and Forsyth 2001, 71-3)</p>
CL029-009089-	569872	685057 Cross-slab	

			<p>Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.88m from the N wall and 6.05m from the E wall). Noted by Macalister (1916-17, 157, no. 54) as of 'twelfth-century type' and described as a slab measuring 5ft 5in (1.65m) by 1ft 8in (0.5m), with a Latin cross with hollowed angles, at the base of the shaft the lines bend outward at 90 degrees and extend to the edges of the slab. (de Paor drawing, SMR file)</p>
CL029-009090-	569872	685057 Cross-slab	<p>A recumbent cross-slab situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (5.38m from the N wall and 6.16m from the E wall). Noted by Macalister (1916-17, 157, no. 55) as of 'twelfth-century type' and described as a slab measuring 4ft 2in (1.27m) by 1ft 6in (0.45m), with a Latin cross with hollowed angles. At the base of the shaft the lines bend outward at 90 degrees and extend to the edges of the slab. (de Paor drawing, SMR file)</p>
CL029-009091-	569872	685057 Cross-slab	<p>Lying on the ground to the S of the OPW chalet on Iniscealtra, among other architectural fragments. A cross-slab depicted in the W half of the 'Saint's graveyard' (CL029-009030-) on Macalister's plan (1916-17, pl. XV) and described (ibid., 157, no. 56) as a cross-slab of 'twelfth-century type' 4ft 10in (1.47m) by 1ft 5in (0.43m) with a double-lined incised Latin cross with hollowed angles. The arms and head of the cross extended to the edges of the slab and at the base the lines bend outwards at 90 degrees and extend to the edge also. De Paor (List 2, SMR file) noted that during his time on the island the slab was in a pile of worked stone beside the wall of the Saint's Graveyard. His drawing shows the slab as broken at a slight angle across the middle. Only the upper portion is now present (L 0.89m).</p>
CL029-009092-	569855	685093 Cross-slab	

A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (21.5m from the S wall and 3.9m from the W wall) and close to the W wall of Teampal na bhfear ngonta (CL029-009015-). Noted by Macalister (1916-17, 157, no. 57) as of 'twelfth-century type' and described as a slab measuring 4ft 2in (1.27m) by 1ft 6in (0.45m), with a Latin cross with hollowed angles in 'slight relief' with the base line carried up to make a frame or panel enclosing the whole design. (de Paor drawing, SMR file)

CL029-009093- 569872 685057 Cross-slab

A recumbent cross-slab, part of a composite grave situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (this slab is 2.5m from the N wall and 3.3m from the E wall of Teampul na bhfear ngonta (CL029-009015-). Noted by Macalister (1916-17, 156, no. 58) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 73-5) as a large cross-slab (H 1.45m; Wth 0.42m; T 0.1m), broken into two pieces with several pieces missing. The face is dressed and incised with an outline Latin cross with hollowed angles and a square base, open at the bottom. An incomplete inscription in two lines across the top of the cross reads '...DOGILLU...EPISCO' (Bishop Gilla-Críst).

CL029-009094- 569876 685069 Cross-slab

A recumbent cross-slab, part of a composite grave situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (this slab is 3.75m from the N wall and 3.3m from the E wall of Teampul na bhfear ngonta (CL029-009015-). Noted by Macalister (1916-17, 156, no. 59) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 76-8) as a large cross-slab (H 1.39m; Wth 0.56m; T 0.9m), with a substantial piece broken off at the top right corner and a small piece broken off the bottom left corner. The face is dressed and incised with an outline Latin cross with hollowed angles and a square base, closed at the bottom. An incomplete inscription in one horizontal line above the top of the cross reads 'ORDOMAE...'.

CL029-009095- 569876 685069 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (22.6m from the S wall and 3.6m from the W wall). Noted by Macalister (1916-17, 156, no. 60) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 78-80) as a large cross-slab (H 1.27m; Wth 0.51m; T 0.8m) with some delamination of the carved surface. The face is dressed and incised with an outline Latin cross with hollowed angles and a rectangular base, open at the bottom, with a faint line separating the shaft from the base. An complete inscription in one vertical line down the shaft of the cross reads 'ORDOMNALL[-]ACART' (oróit do Domnall [s]acart, 'a prayer for Domnall the priest'.

CL029-009096- 569872 685057 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (13.5m from the S wall and 6m from the W wall). Noted by Macalister (1916-17, 158, no. 61) as of 'twelfth-century type' and described as a slab measuring 4ft 11in (1.49m) by 1ft 4in (0.4m), with an outline Latin cross with hollowed angles and a square base, open at the bottom. (de Paor drawing, SMR file)

CL029-009097- 569872 685057 Cross-slab

Mounted against the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 0.9m from the W gable. A cross-slab (L 1.49m; Wth 0.59m; T 0.07m) noted by Macalister (1916-17, 158, no. 62) as of 'twelfth-century type' with a Latin cross with hollowed angles and an expanding base. The outline of the cross is formed by a broad flat band and there is a pellet in each of the four hollows (Okasha and Forsyth, 2001 82). An inscription in two horizontal lines above the top of the cross and upside down with respect to it reads 'ORDODIARMAIT MACCDELBAID'. (Okasha and Forsyth 2001, 81-3)

CL029-009098- 569845 685062 Cross-slab

			<p>A recumbent cross-slab situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.65m from the N wall and 2m from the E wall). Noted by Macalister (1916-17, 158, no. 64) as of 'twelfth-century type' and described as a slab measuring 4ft 2in (1.27m) by 1ft 6in (0.45m), with a Latin cross in double lines with hollowed angles and a rectangular base. Under the base is a pattern comprising an inverted triangle flanked with series of oblique lines. The pattern is not centred to the cross. (de Paor drawing, SMR file)</p>
CL029-009099-	569872	685057 Cross-slab	<p>Situated against the N wall of the nave of St. Mary's church (CL029-009008-) on Inis Cealtra and 3.3m from the W gable. Noted by Macalister (1916-17, 158, no. 65) as of 'twelfth-century type' and described as a slab measuring 1ft 10in (0.55m) by 1ft 9in (0.53m) by 3.5in (0.08m) showing the upper part of a Latin cross with hollowed angles. In Macalister's time it marked a grave outside the W end of St. Mary's.</p>
CL029-009100-	569779	684916 Cross-slab	<p>A recumbent cross-slab situated near the centre of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (13.7m from the S wall and 8.5m from the W wall). Noted by Macalister (1916-17, 158, no. 66) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 85-7) as a large cross-slab (H 1.77m; Wth 0.52m; T 0.6m). The face is incised with an outline Latin cross with hollowed angles. The lower part is much worn. Macalister drew a triangular base and two horizontal lines running from each side of the cross, just above the base to the edges of the stone. These are no longer evident. An incomplete inscription in one vertical line down the shaft of the cross reads 'OR[-]DOMNALL'. The horizontal lines mentioned above are evident in a rubbing (pers. comm. Clíodhna O'Leary, 22 April 2016).</p>
CL029-009101-	569872	685057 Cross-slab	

A recumbent cross-slab situated beside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (19.3m from the S wall and 1.8m from the W wall). Noted by Macalister (1916-17, 159, no. 67) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 87-9) as a large cross-slab (H 1.16m; Wth 0.43m; T 0.5m). The face is incised with an outline Latin cross with hollowed angles. The top and shaft are open. The arms meet lines which frame the length of the slab. The cross sits on a base of unusual shape carved in low relief, consisting of an inverted triangle with large flat bosses at the upper corners and rounded apex. The end of the slab is shaped to a rounded point. An incomplete inscription in two horizontal lines across the top of the cross reads 'SEC | | H | | NAILL [-]DOMAEL'. Taking the lower line first the text reads '...do Máel Sechnaill'.

CL029-009102- 569872 685057 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (6.3m from the S wall and 2.4m from the W wall). Noted by Macalister (1916-17, 159, no. 68) as of 'twelfth-century type' and described as a fragment of a slab measuring 2ft 6in (0.76m) by 1ft 9in (0.53m), bearing the upper part of a cross with hollowed angles. The whole pattern was in a rectangular panel. (de Paor drawing, SMR file)

CL029-009103- 569872 685057 Cross-slab

A recumbent cross-slab, the northernmost of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009160-, CL029-009161- and CL029-009162-). Noted by Macalister (1916-17, 159, no. 69) as 'of twelfth-century date' and described as an elaborately carved slab in which the Latin cross is ornamentally treated. It measures 6ft (1.82m) by 1ft 5in (0.43m) and the cross is in double lines on a square expanding base. The angles are cut with hollowed double squares and the head is brought to a point with lines that cross over each other. The ornamentation in the cantons suggests the wheel of a 'celtic' cross. (de Paor drawing, SMR file)

CL029-009104- 569866 685067 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra 22m from the S wall and 4.1m from the W wall and immediately W of 'Teampul na bhFear nGonta' (CL029-009015-). Noted by Macalister (1916-17, 159, no. 70) as 'of twelfth-century date' and described as an elaborately carved slab in which the Latin cross is ornamentally treated. It measures 6ft by 1ft 9in with a cross in double lines, open at the base. The angles are cut with hollowed double squares and the head is brought to a point. The ornamentation in the cantons suggests the wheel of a 'celtic' cross. (de Paor drawing, SMR file)

CL029-009105- 569872 685057 Cross-slab

Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) and 8m from the W gable. Noted by Macalister (1916-17, 159, no. 71) as of 'twelfth-century type' and described as a slab measuring 4ft 10in (1.47m) by 2ft 5.5in (0.74m) tapering down to 2ft 2.5in (0.67m) bearing a Latin cross of two lines and hollowed angles. The two lower angles are wheeled. The space between the shaft and the enclosing panel is divided into two groups by horizontal lines.

CL029-009106- 569845 685062 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra 13.3m from the S wall and 3.2m from the W wall. Noted by Macalister (1916-17, 160, no. 72) as of 'twelfth-century type' and described as a slab measuring 6ft 4in (1.93m) by 2ft 8in (0.81m) tapering to 2ft (0.6m) bearing a Latin cross of two lines with hollowed angles enclosed in a frame. The top of the cross is pointed and there is a splayed base outside the enclosing frame.

CL029-009107- 569872 685057 Cross-slab

A recumbent cross-slab situated within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (18.4m from the S wall and 7.6m from the W wall). Noted by Macalister (1916-17, 160, no. 74) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 91-3) as a large cross-slab (H 1.76m; Wth 0.45m) tapering towards the base with an incised double-lined Latin cross with hollowed angles and a chequered pattern in the upper quadrants. An incomplete inscription in one vertical line down the shaft of the cross reads 'OR_'.

CL029-009109- 569872 685057 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (15.45m from the S wall and 8.1m from the W wall). Noted by Macalister (1916-17, 160, no. 75) as of 'twelfth-century type' and described as a slab measuring 4ft (1.21m) by 1ft 6in (0.4m), with a Latin cross with hollowed angles. A stepped pattern runs down the sides of the stem, below the arms of the cross and the head is likewise stepped at the top. The central portion is in false relief. (de Paor drawing, SMR file)

CL029-009110- 569872 685057 Cross-slab

A recumbent cross-slab situated in the SW corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (5.3m from the S wall and 2.7m from the W wall). Noted by Macalister (1916-17, 160, no. 76) as of 'twelfth-century type' and described as a slab measuring 6ft 8in (2m) by 2ft 3.5in (0.69m), tapering to 2ft 1in (0.63m) with a Latin cross of double lines with hollowed angles. The base of the stone and the whole background is covered with an ornament of squares and crosses but is much worn. (de Paor drawing, SMR file)

CL029-009111- 569872 685057 Cross-slab

A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (17.3m from the S wall and 2.7m from the W wall). Noted by Macalister (1916-17, 160-61, no. 77) as of 'twelfth-century type' and described as a slab measuring 6ft (1.8m) by 1ft 2in (0.35m) bearing a much-worn pattern. A Latin cross of double lines with hollowed angles. The base of the stone and area to the right of the shaft are covered with an ornament of squares and crosses and the left side has an interlacing pattern. (de Paor drawing, SMR file)

CL029-009112- 569872 685057 Cross-slab

A fragment of a cross-slab (Wth 0.49m; H 0.47m), one of two fragments mounted on the outer face of the W wall of the Saint's Graveyard (CL029-009030-) on Inis Cealtra, 13.6m from the N end (see CL019-009121-). Macalister (1916-17, 161, no. 78) described part of the stem of a three-line cross in a rectangular single-line frame with simple corner pieces, one of which remained. He also noted that the lines of the carving were clogged with cement.

CL029-009113- 569860 685072 Cross-slab

Located against the N wall of the nave of St. Caimin's Church (CL029-009011-) on Inis Cealtra and 7.14m from the W gable. A cross-slab comprising an irregularly shaped sandstone slab (H 0.43m; max. Wth 0.4m) with a single-line Latin cross within a single-line frame. The upper portion is wheeled and the spandrels are decorated with angular lines. There is a circle with a central depression at the head, base and end of each arm of the cross. (Macalister 1916-17, 162, no. 83; de Paor drawing, SMR file)

CL029-009118- 569845 685062 Cross-slab

Situated within the graveyard (CL029-009030-) E of St. Caimin's church on Inis Cealtra. According to the Ordnance Survey Letters (O'Flanagan 1927, vol. 2, 226) a grave, lying a few yards from the SE corner of St Caimin's church (CL029-009011-) marked the burials of 'the twelve saints' who founded the churches on the island. He noted an uninscribed upright stone marking the location of a horizontal one that covered the grave. Many recumbent graveslabs are still in situ in the graveyard but it is not known which of them marked this 'Saint's grave'. A sketch in Petrie and Stokes 1878 (vol. 2, 41) shows four upright stones towards the SE corner of the saint's graveyard which were not to be seen in Macalister's time but which may have been associated. (Macalister 1916, 163, no. 85)

CL029-009120- 569872 685057 Leacht

Located on the ground against the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 5.78m from the W gable. The lower portion (Wth 0.49m; H 0.53m) of an elaborately decorated graveslab noted as 14th-century by Macalister (1916-17, 163). The slab was broken into three portions. The middle portion (Wth 0.43m; H 0.5m; T 0.4m) is mounted beside another graveslab fragment (CL029-009113-) on the wall near the entrance to the Saint's graveyard (CL029-009012-). The upper portion is now missing. The surface of the slab was divided longitudinally into two panels, each containing a floral pattern and there was no cross. Macalister noted (ibid., 164) that while one portion was against the wall of the nave, two portions were on the floor marking modern graves and several other pieces were missing. (Macalister 1916, 163-4, no. 86 and Plate XXIV; de Paor, drawing SMR file)

CL029-009121- 569845 685062 Graveslab

Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 3.66m from the W gable. Noted by Macalister (1916-17, 164, no. 87) as of 14th century date or maybe slightly later and described as a worn slab (6ft 3in (1.9m) by 2ft 6in (0.76), tapering to 1ft 9in (0.53m); T 2.5in (0.06m)) found at St. Mary's church (CL029-009008-). It bears a cross with a rosette in the centre and floral panels filling the angles. A square panel at the base contains a four-leaved flower.

CL029-009122- 569845 685062 Cross-slab

Situated within St. Mary's church (CL029-009008-) on Inis Cealtra, this wall monument is in two portions, the upper portion is on the S wall, 7.5m from the E gable and the lower portion forms the altar at the E end of the church. The upper portion is described by Macalister (1916-17, 164-7, no. 88) as a triangular pediment in a moulded border flanked by pinnacles. A circular depression in the centre contains the O'Brien arms surrounded by a much worn inscription which reads: 'THIS M(ONUME)NT W(AS ERECTED) BY THE LADY S(LANEY) BRIEN (MOTH)ER TO (SR TER)LAGH(MC I BRIEN) HERE LYE THE BODIES OF THE NOBLE KNOGHT SR T(ERL)AGH M I BRIEN ARA BARONETT WHO DIED THE 28 OF MARCH ANNO DNI 1626 AND HIS LADY (elys) BUTLER DAUGHTER TO THE RIGHT HONNORABLE WALTER EARLE OF ORMOND WHO DIED THE X OF FEB. 1625 PRAY FOR THEIR SOULES MEMENTO MORI'. The altar at the E end has a crude carving of the crucifixion flanked with stiff floral panels. According to Macalister (ibid., 166) the total height of the monument would have been 8ft 6in (2.5m) and the breadth 7ft 4in (2.23m).

CL029-009123- 569794 684916 Wall monument

Mounted high on the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 7.82m from the E end. A slab described by Macalister (1916-17, 166-7, no. 89) as a slab (2ft 6.5in (0.77m) by 2ft (0.6m)) bearing three lions passant surrounded by a mantling in the form of floral scrolls. The date 1703 is in the two upper corners and at the base is an inscription which reads: 'VULNERATUS NON VICTUS IA GRADY REPAIRED THOS CHVRCHES AND MOWMENT (sic) TO THE GRACEC (sic) AND GLORIE OF GOD'. A chest-tomb slab (CL029-009125-) also against the S wall of the nave may have formed part of a tomb associated with the wall monument.

CL029-009124- 569846 685056 Wall monument

Mounted against the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 4.55m from the E end. A possible chest-tomb slab (Wth 1.29m; H 0.78m; T 0.1m) dated by Macalister (1916-17, 167, no. 90) to between 1680 and 1750. It bears the letters 'IHS' surmounted by a cross within a rectangular panel with the two upper corners cut off obliquely. This slab may have been associated with the wall monument (CL029-009124-) higher up on the S wall.

CL029-009125- 569846 685056 Tomb - chest torr

Situated in the SW corner of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra and named 'Mod. Stone' on Macalister's plan (1916-17, pl. XV). A low, thin, roughly rectangular, earthfast limestone gravemarker (H 0.49m; L 0.53m; T 0.06m). There is no visible decoration or inscription and the date of this gravemarker is uncertain.

CL029-009127- 569872 685057 Headstone

Situated to the W of the doorway of St. Brigid's church (CL029-009006-) and within the surrounding enclosure/graveyard (CL029-099007-). Excavation by de Paor in 1970-72 (E000180) revealed a copper worker's furnace in the form of a pit in which an ovoid structure of clay had been constructed. This structure bore small splashes of copper and traces of intense heat. (de Paor 1997, 55-6; 2013, 33)

CL029-009128- 569762 684961 Furnace

Situated immediately N of St. Brigid's Church (CL029-009006-) within the enclosure that surrounds it (CL029-009007-). During excavation in 1970-72 (Licence no. E000180) evidence of iron-working was found. Fragments of furnace-bottom were evident in one pit as well as quantities of clinker and bloom. (de Paor 2013, 34, 51)

CL029-009129- 569765 684967 Metalworking site

To the W of the enclosure (CL029-009007-) surrounding St. Brigid's church (CL029-009006-). During excavations by de Paor in 1970-72 (Licence no. E000180) an area of intense metalworking activity was found here with numerous pits, a scatter of clinker and slag. One large pit had been repeatedly refilled with clay and redug, with small hollows showing traces of burning and containing much charcoal. A pit in this area has been radiocarbon dated to Cal AD 1034-1205 (UBA-30140) (Seaver and O'Sullivan 2015, 11-13). Two decorated querns were also found in this area. (de Paor 2013, 34, 51)

CL029-009130- 569743 684954 Metalworking site

Situated at the highest point and just W of the centre of Inis Cealtra and central to a system of fields (CL029-009002-) associated with the monastic remains on the island. A D-shaped enclosure (dims. c. 70m NE-SW; c. 47m NW-SE) with a straight bank at E (Wth 6.4m; ext. H 0.4m; int. H 1.1m). From S to NW the enclosure is defined by a bank (Wth 5.4m; ext. H 0.8m; int. H 0.5m) and from NW to NE by a bank (Wth 6.55m; int. H 0.5m; ext. H 1.4m) external fosse (Wth 1.8m at base) and external bank (Wth 3.2m; int. H 0.4m; ext. H 0.15m). The site of St. Michael's Church (CL029-009003-) and a small associated enclosure (CL029-009004-) lie within and a penitential station (CL029-009052-) in the area is still visited. The enclosure was excavated in 1972 (Excavation no. E000180) revealing a typical bank and fosse profile. There was no evidence of occupation at any period and the enclosure was D-shaped in its original form. A charcoal sample from the straight fosse at E has been radiocarbon dated to Cal AD 905-1023 (UBA-30515)(Seaver and O'Sullivan 2015, 11-14). (dePaor 2013, 36-7)

CL029-009131- 569717 685093 Enclosure

Situated immediately N of the Saint's Graveyard (CL029-009030-) on Inis Cealtra. An overgrown enclosure (diam. c. 15m) defined by a stony bank was excavated by de Paor between 1972 and 1976 (Licence no. E000180) (de Paor 2013, 37). Excavation revealed a drystone wall similar to the enclosures (CL029-009004- and CL029-009007-) around St. Brigid's and St. Michael's churches. Some paving survived around the perimeter. The 'Confessional' (CL029-009017-) lay in the SW quadrant of the enclosure. According to de Paor (ibid.) this was a development associated with remodelling for the purpose of pilgrimage rounds in the 17th/18th century. There was no evidence of an earlier enclosure at this location and there is no enclosure extant.

CL029-009132- 569888 685086 Enclosure

Situated c. 12m N of the Saint's Graveyard (CL029-009030-) on Inis Cealtra. An almost circular fenced enclosure (diam. c. 23m) with evidence of bronze-working was excavated in the 1970s and dated to the 11th century AD (de Paor 2013, 39, 57). Stone 'motif pieces' were found as well as bronze waste and scraps of bronze with ornament in the 'Irish Ringerike' style. A 'stain' of a possible rectangular structure was found in the interior and there were traces of one or more extremely light huts or bothies, in one case with a hearth in the centre. The enclosure overlay earlier burials associated with a graveyard or enclosure (CL029-009135-) around a wooden shrine (CL029-009134-). A pit within the enclosure yielded radiocarbon dates of Cal AD 775-962 (UBA-27539) (Seaver and O'Sullivan 2015, 12-13, 33).

CL029-009133- 569873 685099 Enclosure

Situated c. 10m NW of the 'Confessional' (CL029-009017-) on Inis Cealtra. Traces of a small, timber, rectangular structure of similar dimensions to the confessional (c. 3m x2m) and aligned N-S were found during excavations on the island by de Paor in the 1970s (de Paor 2013, 39, 57). There were traces of a pillared portico at the S end. The structure was aligned within a rectangular palisaded enclosure (CL029-009135-), the S and larger portion of which was overlain by the medieval Saint's Graveyard (CL029-009030-) and not excavated. The wooden structure and the enclosure appeared to have been rebuilt several times and the structure may have been replaced ultimately by the stone confessional. The structure was interpreted as a shrine of Christian origin but modelled on a type of shrine within an enclosure precinct known from Gallo-Roman and Romano-British contexts.

CL029-009134- 569872 685082 Shrine

Situated at the N wall of the Saint's Graveyard (CL029-009030-) on Inis Cealtra. A rectangular palisaded enclosure (c. 18m E-W) was found here during excavations on the island by de Paor in the 1970s (de Paor 2013, 39, 57). Only the smaller N sector was excavated as the S portion extends beneath the Saint's graveyard and this was not excavated. A wooden shrine (CL029-009134-) was excavated in the E sector. Both it and the enclosure appeared to have been rebuilt several times and according to de Paor (ibid.) probably date from a very early stage in the monastic history of the island. Sixteen poorly preserved burials were found within the enclosure, twelve of which were aligned with the enclosure and wooden shrine.

CL029-009135- 569869 685082 Graveyard

Situated c. 30m S of the round tower (CL029-009014-) on Inis Cealtra. The NE quadrant of a circular fenced enclosure (min. diam. 30m) was excavated in 1974 (de Paor 2013, 40, 58). A lean-to structure was attached externally at NE while there was a round house (CL029-009137-) in the interior. According to de Paor (ibid.) the house was probably not related to the enclosure. It occurred in an area with a maze of stake-holes, wattle holes, post-holes and timber stains in the soil with evidence of activity over a long period.

CL029-009136- 569819 685020 Enclosure

Situated c. 28m SSW of the round tower (CL029-009014-) on Inis Cealtra. Traces of a round house (diam. c. 10m) were excavated in 1974 (de Paor 2013, 40, 58). The house was divided internally by straight partitions, had a central hearth, and also had a projecting porch at SW. According to de Paor (ibid.) the house 'was not built with posts dug into the ground: there was an outer tegument which showed as a dark brown stain, with some wattle-holes, as from the light base timbers of a wattle or boarded structure, and within this slot, which defined the shape of the building, there were traces of massive posts (perhaps of 30cm diam.) which were not sunk in the earth but rested on pads of some kind.' A hoard of 21 very worn early Norman coins were found underneath the hearth. One coin was of Stephen (1135-1154) and the others were of Henry II (1154-1189).

CL029-009137- 569822 685018 House - medieval

Situated c. 25m SW of the round tower (CL029-009014-) and c. 3m N of a fenced enclosure (CL029-009136-) on Inis Cealtra. Traces of an oval house (diam. c. 10m) were excavated in 1974 (de Paor 2013, 40, 58). A house of similar size (CL029-009137-) was excavated within the fenced enclosure.

CL029-009138- 569812 685028 House - medieval

Situated c. 18m WSW of the round tower on Inis Cealtra. An earthen church was excavated here in 1974 (de Paor 2013, 40-41, 58). A rectangular building, rebuilt a number of times on slightly different orientations. The earliest phase of building (5.5m x 4.1m) was orientated exactly the same as St. Brigid's church (CL029-009006-) and had a trodden clay floor. The walls (T over 2.5m) were defined by rows of wattle- or stake-holes and there was an entrance in the W wall. Close-set wattles appear to have been used as internal reinforcement. Rebuildings altered the orientation, first to almost NE-SW and then closer to E-W. This church, according to de Paor, represents the early phase of the monastery. The church was cut by a medieval house (CL029-009138-).

CL029-009139- 569809 685044 Church

Situated immediately NE of the round tower (CL029-009010-) and N and W of St. Caimin's church (CL029-009011-) on Inis Cealtra. Numerous burials were excavated in this area in the 1970's (de Paor 2013, 41, 58). They were shallow, with much disturbed and scattered bone. Although they were crowded together close to the foundations, the interments in these positions had been made after the construction of the buildings.

CL029-009140- 569833 685054 Burial

Situated c. 35m SW of the round tower (CL029-009010-) on Inis Cealtra and in the vicinity of two bullaun stones (CL029-009028- and CL029-009029-). A quantity of cupric slag and a number of pits, filled with stones at surface level were excavated here in 1977-9 by de Paor (2013, 42-3). The soil underneath both bullauns contained some slag and bones and was flecked with charcoal. A pit close to the bullauns provided a date of Cal AD 727-886 (UBA-30141) (Seaver and O'Sullivan 2015, 11-13).

CL029-009141- 569815 685012 Metalworking site

			Situated in the SW corner of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 4.3m from the S wall and 2.5m from the W wall. An undecorated recumbent graveslab (L 1.49m; Wth 0.71m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009142-	569872	685057 Graveslab	
			Situated in the SW corner of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 7.3m from the S wall and 2.7m from the W wall. An undecorated recumbent graveslab (L 1.57m; Wth 0.59m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009143-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 9.25m from the S wall and 0.8m from the W wall. An undecorated recumbent graveslab (L 0.52m; Wth 0.38m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009144-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 11.3m from the S wall and 3m from the W wall. An undecorated recumbent graveslab (L 1.64m; Wth 0.62m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009145-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 16.3m from the S wall and 2.9m from the W wall. An undecorated recumbent graveslab apparently in two pieces, the W portion (L 1.2m; Wth 0.45m) and the E portion (L 0.68m; Wth 0.42m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009146-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 17m from the S wall and 2.5m from the W wall. An undecorated recumbent graveslab (L 1.14m; Wth 0.41m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009147-	569872	685057 Graveslab	

			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 19.75m from the S wall and 3.3m from the W wall. An undecorated recumbent graveslab (L 1.45m; Wth 0.45m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009148-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 20.3m from the S wall and 3m from the W wall. An undecorated recumbent graveslab (L 1.2m; Wth 0.64m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009149-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 21.5m from the S wall and 1.9m from the W wall. An undecorated recumbent graveslab (L 0.88m; Wth 0.61m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009150-	569872	685057 Graveslab	
			Situated in the NW quadrant of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 22.3m from the S wall and 1.9m from the W wall. An undecorated recumbent graveslab (L 1.14m; Wth 0.74m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009151-	569872	685057 Graveslab	
			Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 14.6m from the S wall and 6m from the W wall. An undecorated recumbent graveslab (L 1.5m; Wth 0.47m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009152-	569872	685057 Graveslab	
			Situated in the SW corner of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 1.5m E of the small kerbed enclosure containing a cross-base (CL029-009016-) and 7.7m from the S wall. An undecorated recumbent graveslab (L 1.2m; Wth 0.42m at the W end and 0.12m at the E end) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009153-	569872	685057 Graveslab	

			<p>Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.6m from the S wall and 8.5m from the W wall. A recumbent cross-slab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). This is now completely grassed over but the outline is discernible under the sod (L 1.77m; Wth 0.42m). Drawn by de Paor (SMR file) as a broken slab with a double-line Latin cross with hollowed angles on a square base.</p>
CL029-009154-	569872	685057 Cross-slab	
			<p>Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 13m from the S wall and 8.5m from the W wall. An undecorated recumbent graveslab (L 1.65m; Wth 0.47m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009155-	569872	685057 Graveslab	
			<p>Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 15.9m from the S wall and 8.1m from the W wall. An undecorated recumbent graveslab (L 0.84m; Wth 0.23m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009156-	569872	685057 Graveslab	
			<p>Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 16.4m from the S wall and 8.15m from the W wall. An undecorated and partially sod-covered recumbent graveslab (L 0.53m; traceable Wth 0.4m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009157-	569872	685057 Graveslab	
			<p>Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 18.9m from the S wall and 7.6m from the W wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009158-	569872	685057 Graveslab	

Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 19.7m from the S wall and 8.2m from the W wall. An undecorated recumbent graveslab (L 1.21m; Wth 0.48m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).

CL029-009159- 569872 685057 Graveslab

A recumbent graveslab (L 1.12m; Wth 0.28m), the southernmost of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009104-, CL029-009161- and CL029-009162-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. The slab is drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).

CL029-009160- 569866 685067 Graveslab

A recumbent graveslab (L 1.17m; Wth 0.28m), one of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009104-, CL029-009160- and CL029-009162-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. The slab is drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). This may be a reused architectural fragment as there is incised rope moulding running along the N side of the slab. A second smaller stone to the W has similar moulding but is not recorded as a graveslab by Macalister.

CL029-009161- 569866 685067 Graveslab

A recumbent graveslab (L 2.06m; Wth 0.57m), one of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009104-, CL029-009160- and CL029-009161-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. The slab is drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV) and is broken into three pieces.

CL029-009162- 569866 685067 Graveslab

Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 18m from the S wall and 9.9m from the W wall. An undecorated recumbent graveslab (L 1.46m; Wth 0.51m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).

CL029-009163- 569872 685057 Graveslab

			<p>Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.55m from the N wall and 11.45m from the E wall. A recumbent graveslab (L 0.98m; Wth at top 0.74m; Wth at base 0.65m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). An incised line extends E-W 0.11m in from the straight N edge but the stone is otherwise undecorated.</p>
CL029-009164-	569872	685057 Graveslab	
			<p>Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 11.25m from the N wall and 11.45m from the E wall. An undecorated, uneven, recumbent graveslab (L 1.2m E-W; Wth 0.49m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009165-	569872	685057 Graveslab	
			<p>Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 10.65m from the N wall and 11.6m from the E wall. An undecorated, uneven, recumbent graveslab (L 1.13m E-W; Wth 0.42m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009166-	569872	685057 Graveslab	
			<p>Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) and 8.69m from the N wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. An undecorated graveslab (L 1.02m E-W; Wth 0.4m), broken in two.</p>
CL029-009167-	569872	685057 Graveslab	

			<p>Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) and 8.18m from the N wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A graveslab (L 1.27m E-W; Wth 0.46m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). Although this slab is not numbered or described by Macalister it has a deeply incised single-line cross running the length of the slab. The cross has hollowed angles and the shaft is open-ended. Portion of the top of the cross is grassed-over.</p>
CL029-009168-	569872	685057 Cross-slab	<p>Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) and 6.98m from the N wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A graveslab (L 0.6m E-W; Wth 0.46m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). Although not numbered or described by Macalister, this slab has a cross in relief with hollowed angles and expanded and squared terminals.</p>
CL029-009169-	569872	685057 Cross-slab	<p>Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra and 5.98m from the N wall of the graveyard. A recumbent graveslab (L 0.73m; Wth 0.38m) indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). De Paor depicts the faint outline of a carved wheeled cross with ornamentation consisting of small crosses on one side of the shaft (drawing, SMR file); due to weathering it is unclear whether de Paor's drawing refers to this slab, an adjacent one (CL029-009171-) or indeed one that may now be completely overgrown.</p>
CL029-009170-	569872	685057 Cross-slab	

Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra and 5.57m from the N wall of the graveyard. A recumbent graveslab (L 0.59m E-W; Wth 0.25m) with a rough and uneven surface indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). De Paor depicts the faint outline of a carved wheeled cross with ornamentation consisting of small crosses on one side of the shaft (drawing, SMR file); due to weathering it is unclear whether de Paor's drawing refers to this slab, an adjacent one (CL029-009170-) or indeed one that may now be completely overgrown.

CL029-009171- 569872 685057 Graveslab

Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra and 4.8m from the N wall of the graveyard. A rough, uneven, recumbent graveslab (L 1.14m E-W; Wth 0.44m at the top; Wth 0.4m at the base) indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). A slab of similar length but only c. 0.12m wide lies immediately to the N, similar to the kerbstones around the composite grave (CL029-009210-) adjacent to the E.

CL029-009172- 569872 685057 Graveslab

Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 3.3m from the E wall of Teampul na bhFear nGonta (CL029-009015-) and 2.05m from the N wall of the graveyard. A narrow slab (L 1.35m E-W; Wth at top 0.12m; Wth at base 0.1m) forming the N edge of a composite grave (CL029-009210-). The slab is drawn as a wider, undecorated and unnumbered slab on Macalister's plan of the graveyard (1916-17, pl. XV). An inscription at the W end reads '+ OR DO THRESSACH +' with a cross at the beginning and the end. At least one of the S's is reversed. A mortise-like hollow on the S face of the slab at the E end may be related to the construction of the composite grave. (Tunney and Manning 2015, 42-3)

CL029-009173- 569876 685069 Graveslab

Situated in the SE corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 4.7m from the E wall and 6.34m from the S wall. A plain, uneven graveslab (L 1.25m; Wth, 0.66m) indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).

CL029-009174- 569872 685057 Graveslab

This record is for the original location of an undecorated graveslab depicted but not numbered on Macalister's plan of the 'Saint's graveyard' (CL029-009030-) (1916-17, pl. XV) close to the centre. The slab is no longer evident at this location and its present location is unknown.

CL029-009175- 569872 685057 Graveslab

Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.55m from the N wall and 6.05m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab has an uneven surface and is broken in two with a diagonal break across the centre.

CL029-009176- 569872 685057 Graveslab

Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 6.1m from the N wall and 6.16m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab (L 0.81m; Wth 0.39m) has an uneven surface and is partially grassed over.

CL029-009177- 569872 685057 Graveslab

Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 14.08m from the N wall and 4.06m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab (L 1.27m; Wth 0.52m) has an uneven surface.

CL029-009178- 569872 685057 Graveslab

			<p>Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 13.45m from the N wall and 4.06m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab (L 1.04m; Wth 0.42m) has an uneven surface.</p>
CL029-009179-	569872	685057 Graveslab	<p>Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.63m from the N wall and 2m from the E wall. An undecorated recumbent graveslab (L1.42m; Wth at top 0.48m; Wth lower third 0.23m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab has a rough uneven surface.</p>
CL029-009180-	569872	685057 Graveslab	<p>This record is for the original location of an undecorated graveslab depicted but not numbered on Macalister's plan of the 'Saint's graveyard' (CL029-009030-) (1916-17, pl. XV) close to the E wall. The slab is no longer evident at this location and its present location is unknown.</p>
CL029-009181-	569872	685057 Graveslab	<p>Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 8.46m from the N wall and 2.2m from the E wall. An undecorated recumbent graveslab (L1.56m; Wth 0.49m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab is uneven has natural striations on the surface.</p>
CL029-009182-	569872	685057 Graveslab	<p>Situated in the NE corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 7.9m from the N wall and 2.2m from the E wall. An undecorated recumbent graveslab (L1.2m; Wth 0.55m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009183-	569872	685057 Graveslab	

			<p>Situated in the NE corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 7.25m from the N wall and 2.2m from the E wall. An recumbent graveslab (L1.34m; Wth 0.5m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). There is an oval quartz inclusion towards the bottom of the slab but it is otherwise undecorated.</p>
CL029-009184-	569872	685057 Graveslab	
			<p>Situated in the OPW chalet on Inis Cealtra. A rough sandstone block (H 0.24m; Wth 0.21m; T 0.06m) with a single-lined incised Latin cross with very slightly expanded terminals placed centrally.</p>
CL029-009185-	569854	685099 Cross-inscribed st	
			<p>Situated in the OPW chalet on Inis Cealtra. A trapezoidal-shaped stone (max. L 0.25m; Wth 0.19m; T 0.05m) with a shallow rectangular slot (0.09m x 0.05m; D 0.01m) centrally placed. The sides of the socket are angled.</p>
CL029-009186-	569854	685099 Cross	
			<p>Situated 33m W of the round tower (CL029-009010-) on Inis Cealtra. A grass-covered subrectangular mound of earth and stones (2.8m N-S; 2m E-W; max. H at S 0.45m). An earthfast slab (L 0.4m; H 0.2m; T 0.7m) at NW may have been a kerbstone. A second earthfast stone at SE (Wth 0.3m; H 0.3m; T 0.12m) is falling or pushed outwards and may also have served as a kerbstone. Mentioned in the OS Letters for County Galway (O'Flanagan 1927, vol. 2, 227-8) as forming part of a pattern held on the island.</p>
CL029-009187-	569793	685050 Penitential statio	
			<p>Situated in the W half of the 'Saint's graveyard' (CL029-009030-) in a row of graveslabs (between CL029-009089- (Macalister no. 53) and CL029-009110- (Macalister no. 75)), 14.9m from the W wall of the graveyard and 7.8m from the W wall. This tapering limestone slab (L 1.28m; Wth at W 0.42m; Wth at E 0.22m) has no decoration or inscription and is not illustrated in Macalister's plan of the graveyard (1916-17, pl. XV).</p>
CL029-009188-	569872	685057 Graveslab	

Situated towards the centre of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 14.1m from the S wall and 10.7m from the W wall. An undecorated limestone slab (L 1.5m; Wth 0.43m) not recorded on Macalister's plan of the graveyard (1916-17, pl. XV).

CL029-009189- 569872 685057 Graveslab

Situated inside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra to the S of the entrance. The southernmost in a row of four small undecorated graveslabs (see CL029-009144-, CL029-009191- and CL029-009192-). Only CL029-009144- is illustrated on Macalister's plan of the graveyard (1916-17, pl. XV). This slab (L 0.9m E-W; Wth 0.47m) is 7.7m from the S wall and 0.9m from the W wall of the graveyard.

CL029-009190- 569872 685057 Graveslab

Situated inside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra to the S of the entrance. One of four small undecorated graveslabs in a row (see CL029-009144-, CL029-009190- and CL029-009192-). Only CL029-009144- is illustrated on Macalister's plan of the graveyard (1916-17, pl. XV). This slab (L 0.68m E-W; Wth 0.53m) is 8.3m from the S wall and 0.9m from the W wall of the graveyard and appears to be in two pieces.

CL029-009191- 569872 685057 Graveslab

Situated inside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra to the S of the entrance. One of four small undecorated graveslabs in a row (see CL029-009144-, CL029-009190- and CL029-009191-). Only CL029-009144- is illustrated on Macalister's plan of the graveyard (1916-17, pl. XV). This slab (L 0.83m E-W; Wth 0.46m) is 8.8m from the S wall and 0.9m from the W wall of the graveyard.

CL029-009192- 569872 685057 Graveslab

			<p>Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. This slab (L 1.65m; Wth 0.58m) is not depicted on Macalister's plan of the graveyard (1916-17, pl. XV) but it lies between his no. 46 (CL029-009082-) and no. 51 (CL029-009087-), 12.2m from the N wall and 4.06m from the E wall of the graveyard. There is an incised single-line cross near the edge of the slab at the W end. The line of the arms of the cross is not quite at right-angles to the shaft. (De Paor, drawing, SMR file)</p>
CL029-009193-	569872	685057 Cross-slab	<p>Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. This slab (L 0.69m; Wth 0.49m) is not depicted on Macalister's plan of the graveyard (1916-17, pl. XV) but it lies immediately W of his no. 64 (CL029-009099-), 11.65m from the N wall and 3.1m from the E wall of the graveyard. The slab is irregularly shaped and has a rough uneven surface.</p>
CL029-009194-	569872	685057 Graveslab	<p>Situated in the graveyard (CL029-009012-) S of St. Caimin's church (CL029-009011-) on Inis Cealtra, 4m S of the doorway linking this graveyard and the 'Saint's graveyard' (CL029-009030-). An erect earthfast stone aligned N-S (H 0.84m; T 0.15; Wth at base 0.64m shouldered at the sides and narrowing to 0.34m at the top). The top of the stone is broken off. The W face has a central vertical carving (Wth 0.025m) comprising a rib flanked on each side by an incised line. The line extends 0.44m down from the broken top of the stone and may represent a cross shaft.</p>
CL029-009195-	569860	685051 Cross-inscribed st	<p>Situated on the floor along the N wall of the nave of St. Caimin's church (CL029-009011-). A fragment of a cross-inscribed sandstone slab (H 0.22m; Wth 0.21m; T 0.05m) with one curved edge. It may originally have been subcircular. A simple single-lined equal-armed cross appears to be central to the original shape of the slab.</p>
CL029-009196-	569845	685062 Cross-inscribed st	

			<p>Mounted in an inverted position against the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 2.88m from the E end. A cross-slab (H 0.51m; Wth 0.33m; T 0.06m) found during excavations in 1970-72. The slab bears an outline Latin cross with square expanded terminals and a square at the centre enclosed in a double-lined frame. The text, in two lines in the upper quadrant reads 'FLA[ITH] BERTACH'. The same name occurs on another cross-slab (CL029-009088-) in St. Caimin's church. (Okasha and Forsyth 2001, 99-101)</p>
CL029-009198-	569846	685056 Cross-slab	<p>Situated against the S wall of the nave of St. Caimin's church (CL029-009011-) and 2m from the E end. A fragment of a possible cross-shaft (H 0.32m; Wth 0.29m) with a roll-moulding at one edge. Although uncertain this may be a portion of a fragment of a cross (CL029-009114-) described and illustrated by Macalister (1916-17, 161, no. 79). (De Paor, drawing, SMR file)</p>
CL029-009199-	569846	685056 Cross	<p>Situated against the S wall of the nave of St. Caimin's church (CL029-009011-) and 4.4m from the E end. A subrectangular fragment of a sandstone cross-slab (max. Wth 0.26m; H 0.17m; T 0.05m) showing the top portion of an incised wheeled cross.</p>
CL029-009200-	569846	685056 Cross-slab	<p>Located near the W gable wall of St. Caimin's church (CL029-009011-) just N of the doorway. A possible cross-base (originally in the Saint's Graveyard, see Macalister (1916-17, pl. XV, close to 38(26)) comprising a subcircular, sandstone, flat-topped block (0.32m x 0.3m) with a circular, flat-bottomed socket (diam. 0.08m; D 0.05m) inside a carved circle. Two opposing radial lines extend from the socket to the circle. Macalister (ibid., 152) notes that this may have been a door-socket.</p>
CL029-009201-	569845	685062 Cross	<p>Situated against the N wall of the nave of St. Mary's church (CL029-009008-) and 5.44m from the W gable. Part of a cross-slab (H 0.61m; Wth 0.44m; T 0.09m) with two incised parallel lines 0.08m apart off-centre and at an angle, veering towards the edge of the slab.</p>
CL029-009202-	569782	684916 Cross-slab	

			Situated in the OPW chalet on Inis Cealtra. The base of a cross, comprising a subcircular boulder (0.35m x 0.37m) with a rectangular socket (0.15m x 0.07m; D 0.03m).
CL029-009203-	569854	685099 Cross	
			Situated on fairly level ground c. 15m N of St. Caimin's church (CL029-009011-) on Inis Cealtra. A subcircular, grass-covered mound with a flattish top (4.6m E-W; 4.15m N-S; Wth across top 0.9-1.3m). A stone (L 0.34m) set along the perimeter at NE may have been a revetting stone. A second stone (L 0.3m) at S is set perpendicular to the mound. According to the OS Letters (O'Flanagan 1927, vol. 2, 228) pilgrims went round a station monument at the 'end of St. Caimin's church'.
CL029-009208-	569854	685077 Penitential statio	
			Lying loose against the W wall of St. Caimin's graveyard (CL029-009012-) on Inis Cealtra. A tall, slightly tapering stone with a sloping top (L 1.12m; Wth at base 0.12m; Wth in middle 0.2m; Wth at top 0.16m; T 0.14 at base and 0.12m at the top). The lowest 0.2m is rough and may have been under ground. One face is worked smooth and flat with 5 small depressions (diam. 0.02m (smallest) to 0.04m (largest)), some circular and some oval, arranged in serpentine fashion 0.34-0.5m up from the base. No other markings are evident. The precise original location of this stone is unknown.
CL029-009209-	569851	685033 Pillar stone	
			Situated in the E half of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra and 3.3m from the E wall of Teampul na bhfear ngonta (CL029-009015-). A composite grave of recumbent slabs separated and framed by a series of kerb-like slabs, two at the top, five along the base and one at north. A continuity of the eastern kerb is suggested by the presence of a single thin slab protruding above ground level. There were originally at least five slabs. Two of the remaining slabs are cross-slabs (CL029-009095- and CL029-009094-) and two have inscriptions (CL029-009068- and CL029-009173-). A mortise-like depression on the S face of the most northerly kerbstone may have functioned as a slot into which the adjoining eastern kerbstone fitted at this corner. (Okasha and Forsyth 2001, 64; Tunney and Manning 2015, 42-3)
CL029-009210-	569876	685069 Graveslab	

Situated in the NE quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra at the head of a cross-slab (CL029-009070-). A long, low, socketed stone (L 1.01m; average Wth 0.14m; H 0.18m) oriented N-S. The socket (int. L 0.19m; Wth 0.09m; D 0.06-0.07m) is 0.18m from the S end of the stone and 0.56m from the N end.

CL029-009212- 569872 685057 Cross

Situated N of the round tower (CL029-009010-) on Inis Cealtra. Excavations took place in this area (licence no. E000180) in the 1970s (de Paor 2013). Post excavation work in 2015 resulted in a radiocarbon date of Cal AD 551-639 (UBA-30514) from a 'trench' or ditch showing the presence of features dating from the reputed foundation of the ecclesiastical site. (de Paor 2013, 58; Seaver and O'Sullivan 2015, 11-13)

CL029-009214- 569815 685060 Excavation - misc

Situated c. 9m NW of the round tower (CL029-009010-) on Inis Cealtra. Excavations in the 1970s (licence no. E000180) revealed burials in this area (de Paor 2013), possibly linked to the earthen church (CL029-009139-). Post-excavation work in 2015 yielded radiocarbon dates of Cal AD 777-992 (UBA-27100) and Cal AD 725-979 (UBA-27101). (Seaver and O'Sullivan 2015, 11-13, 34)

CL029-009215- 569824 685059 Burial

Situated in the fosse of the D-shaped enclosure (CL029-009) around St Michael's Church (CL029-009) on Inis Cealtra. Excavations in the 1970s (licence no. E000180) revealed a burial cut into the fosse of the enclosure. Post-excavation work in 2015 yielded a radiocarbon date range of Cal AD 1024-1163 (UBA-30142). The burial is possibly of a female aged 25-35. (Seaver and O'Sullivan 2015, 11-14, 35)

CL029-009216- 569743 685121 Burial

APPENDIX 14.1

GEOPHYSICAL SURVEY PRELIMINARY REPORT 21R0095



VOLUME III

APPENDICES TO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

GEOPHYSICAL SURVEY

PRELIMINARY REPORT

Holy Island (Inishcaltra),
Lough Derg,
County Clare

Date:
15/06/2021

Licence: 21R0095

J. M. Leigh Surveys Ltd.
124 Oaklawn West
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GEOPHYSICAL SURVEY SUMMARY SHEET
HOLY ISLAND, LOUGH DERG, COUNTY CLARE

Site Name	Holy Island, Co. Clare	Ref No.	21018
Townland	Inishcaltra / Holy Island	Licence No.	21-R-0095
County	County Clare	Licence Holder	Joanna Leigh
ITM (centre)	E569643, N684947	Purpose	Research
Client	Archaeological Projects Ltd.	Reference No.	N/A

Ground Conditions Survey was conducted within all accessible areas of Holy Island (Inishcaltra). Ground conditions comprised pasture with some dense vegetation, particularly around the perimeter.

Survey Type Detailed gradiometer survey totalling c. 15 hectares.

Field Staff Joanna Leigh & Susan Curran

Report Date 15/06/2021 **Report Author** Susan Curran & Joanna Leigh

Summary of Results

The geophysical survey has identified multiple responses which are consistent with a number of the recorded archaeological monuments and topographic features on Holy Island. It has also successfully identified further responses which provide additional layers of detail as to the morphology and extent of many of these features. These include the D-shaped enclosure, field system, and 'Pilgrim's Road'.

Two concentric ditched features have been identified in the vicinity of St. Caimin's Church. These are of clear archaeological interest and potential significance relating to the development of Inishcaltra as an ecclesiastical site. Their morphology is consistent with enclosing features used to demarcate varying levels of sanctity at early ecclesiastical sites.

An irregular shaped enclosure at the southern tip of the island is of archaeological potential. While the responses do not form a readily coherent pattern, the clearly defined magnetic responses are indicative of archaeological ditched features. A series of parallel trends to the north-east of this may represent the remains of an associated access or approach; this is speculative.

Three large circular trends (c. 30m, 35m & 53m) & have been identified which are suggestive of plough-damaged enclosures. They may represent earlier activity at the site; this is speculative, however, as the responses are poorly defined and may equally represent natural variations in the sub-soil.

Smaller curvilinear trends have also been identified. While they may represent further habitation activity at the site, they are poorly defined and an archaeological interpretation is cautious.

A ditch type response close to the recorded holy well may represent the remains of a paved road linking St. Caimin's with St. Mary's (depicted on OS 6inch and 25inch mapping). This is speculative as only a small part of this area was accessible and its full extent could not be established.

Possible pit-type responses may be associated with the recorded penitential station; this is speculative as they do not form a clear pattern.

Extensive agricultural activity is evident at the site in the form of several series of probable ridge and furrow cultivation. These, combined with possible field boundaries identified by the survey, point to several phases of activity and/or land use at the site. It is clear that the recorded field systems are more extensive than previously understood.

Multiple areas of burning have been identified throughout the site, particularly in the north, east, and south. These are suggestive of spreads of burnt material and may represent the remains of hearths, kilns and/or metalworking.

Several poorly defined rectilinear responses have been identified which may represent further habitation activity, although this is speculative.

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Geophysical Survey Report

Holy Island, Lough Derg, County Clare

1 Introduction

- 1.1 A geophysical survey has been conducted by J. M. Leigh Surveys Ltd. on the island of Inishcaltra or Holy Island on Lough Derg, County Clare. The survey was requested by Archaeology Projects Ltd. on behalf of Clare County Council as part of a wider study in advance of a proposed project aimed at tourist development and visitor management on the island.
- 1.2 The application area comprises the island of Inishcaltra (Holy Island) which is located on Lough Derg. The survey area comprised all accessible parts of the island, largely excluding those areas that were previously excavated. Excavations were undertaken by Liam de Paor in the 1970s at multiple locations on the island (Licence E000180). These were mainly centred around the recorded monuments in the central and eastern parts of the island. Figure 1 presents the site and survey location at a scale of 1:2,750.
- 1.3 Inishcaltra (Holy Island) is home to 193 recorded monuments (www.archaeology.ie), the majority of which are ecclesiastical in nature. These are largely located within the central and eastern parts of the island, with three recorded bullaun stones (CL029-009019, CL029-009020, CL029-009024) positioned along the northern shore. The central area comprises a D-shaped enclosure (CL029-009131) within which is located St. Michael's Church (CL029-009003), a small associated enclosure recorded as a 'Graveyard' (CL029-009004) and a 'Penitential station' (CL029-009052). A 'Burial' (CL029-009216) was uncovered in this area over the course of Liam de Paor's excavations in the 1970s (Licence E000180). The remaining 185 recorded monuments are located on the eastern half of the island, comprising five churches in addition to multiple crosses, cross-slabs, graveslabs, bullaun stones and many other monument types associated with the ecclesiastical centre.
- 1.4 The main aim of the survey was to explore the nature and extent of the existing earthworks and recorded monuments on Inishcaltra. In addition, the survey sought to identify any responses which may represent previously unknown archaeological remains associated with the ecclesiastical site and/or other phases of activity. It is the objective of the survey to identify the location, nature and extent of any responses of potential archaeological interest.

- 1.5 The detailed gradiometer survey was conducted under licence 21R0095 issued by the Department of Housing, Local Government and Heritage.

2 Survey ground conditions and further information

- 2.1 The survey area was contained within the extent of Holy Island and largely comprised pasture. Dense vegetation envelopes much of its shoreline with pockets of thick vegetation (brambles etc.) throughout the interior. Survey was undertaken in all accessible areas, largely excluding those which had been previously excavated. For ease of reference and better representation of the dataset, the island has been divided into three areas, A, B and C.
- 2.2 Area A comprises the northern half of the island. Ground conditions comprised short pasture with substantial trees and dense vegetation covering much of the northern shoreline; survey was undertaken where accessible. The ground slopes gently to the east.
- 2.3 Area B comprises the central part of Holy Island. This area encompasses the majority of the recorded monuments, including the round tower, St. Caimin's Church with its associated graveyards, St. Brigid's Church, in addition to the extant enclosures and series of earthworks. Liam de Paor's excavations were largely undertaken within this area, predominately centred on the upstanding monuments. Survey was impeded in places by dense pockets of vegetation, particularly within the D-shaped enclosure and immediately surrounding the churches and graveyards.
- 2.4 Area C encompasses the southern half of the island, and for the most part comprised pasture. The southern shoreline was largely inaccessible due to dense vegetation in the form of brambles, rushes and irises. This area comprises St. Mary's Church and the holy well (CL029-009023). Thick vegetation impeded survey in the areas immediately surrounding the recorded monuments; survey was undertaken in all accessible areas.

3 Survey Methodology

- 3.1 A detailed gradiometer survey detects subtle variations in the local magnetic field and measurements are recorded in nano-Tesla (nT). Some archaeological features such as ditches, large pits and fired features have an enhanced magnetic signal and can be detected through recorded survey.

- 3.2 Data was collected with a Bartington Grad 601-2 instrument. This is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey fast and effective.
- 3.3 The instrument is calibrated in the field to ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.01nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.
- 3.4 All data was collected in 'zigzag' traverses. With the exception of the area within the Saint's graveyard at St. Caimin's Church and the strip of clearing leading to the holy well, grid orientation remained constant throughout to facilitate the data display and interpretation.
- 3.5 Data was collected with a sample interval of 0.25m and a traverse interval of 1m, providing 6400 readings per 40m x 40m grid. The survey grid was set out using a GPS VRS unit. Survey tie-in information is available upon request.
- 3.6 The survey methodology, data presentation and report content adhere to the European Archaeological Council (EAC) (2016) 'Guidelines for the use of Geophysics in Archaeology'.

4 Data display

- 4.1 An overall summary greyscale image and accompanying interpretation diagram are presented in Figures 2 and 3, at a scale of 1:2,000.
- 4.2 For ease of reference and better representation of the figures, the survey area has been sub-divided into three smaller areas (A, B and C). These greyscale images and interpretation diagrams are presented in Figures 4-9 at a scale of 1:1,000.
- 4.3 Numbers in parenthesis in the text refer to specific responses highlighted in the interpretation diagram (Figure 3, 5, 7 & 9).
- 4.4 Isolated ferrous responses highlighted in the interpretation diagram most likely represent modern ferrous litter and debris and are not of archaeological interest. These are not discussed in the text unless considered relevant.
- 4.5 Archive plots (greyscale image & xy-trace plot) were used to aid interpretation of the results and are available as PDF images upon request.
- 4.6 The display formats referred to above and the interpretation categories are discussed in the summary technical information section at the end of this report.

5 Survey Results

Area A (Figures 4 & 5)

- 5.1 A series of clearly defined negative and positive responses and trends (1) form a linear pattern which runs south-eastwards from the north of the island towards the main ecclesiastical remains. The responses are indicative of an embankment with an associated positive linear response along its western extent. This embankment is visible on the ground and the positive responses correspond with the location of the 'Pilgrim's Road' which runs from the northern jetty to the main monastic site and is still in use today. This also forms part of the topographic features associated with the recorded field system (CL029-009002).
- 5.2 A series of fragmented positive magnetic responses and trends (2) form a linear pattern c. 80m to the west of (1). This is suggestive of a ditched feature and may constitute a further piece of the field system, although this is speculative. This feature has a similar orientation to (1) and runs northwards from the D-shaped enclosure (CL029-009131) towards the 'Fairy tree' which is recorded on the topographic map.
- 5.3 Immediately east of (2), three clearly defined responses (3) are suggestive of burning activity. These are of clear archaeological potential and may represent the remains of in-situ burning or possible hearths or kilns.
- 5.4 A series of responses (4) form an irregular pattern c. 14m west of (1). Although no clear archaeological pattern is evident, the responses are typical of short ditched features or large pits. They are of clear archaeological potential.
- 5.5 A poorly defined curvilinear trend (5) has also been identified which appears to enclose (4) and is c. 35m in diameter. This is speculative and they may not necessarily relate to the same phase of activity. This response is at the limits of instrument detection and an archaeological interpretation is cautious.
- 5.6 Within two adjacent clearings in the eastern half of Area A, a series of clearly defined responses within an area of increased magnetic response (6) have been identified. These are suggestive of burning and may represent a spread of burnt material; this is speculative but must be considered. Substantial vegetation along the eastern side of the island made much of this area inaccessible and it was not possible to determine the full extent of these responses; however, they are of clear archaeological potential. A series of responses with a similar magnetic signature have been identified in Area B (26).

- 5.7 A series of fragmented positive magnetic responses and trends (7) form a curvilinear pattern at the northern end of (1). This is suggestive of a ditched feature, possibly the partial remains of a circular enclosure which was truncated by the Pilgrim's Road, although this is speculative. An archaeological interpretation is cautious, and it may equally represent ground disturbance associated with the roadway.
- 5.8 In the north-eastern corner of Area A, two responses (8) have been identified which have a magnetic signature indicative of burnt material. These are of archaeological potential and may represent a cluster of pits.
- 5.9 Multiple discrete positive magnetic responses (9) are evident throughout Area A (and the whole dataset). They are suggestive of isolated pit-type responses. However, an archaeological interpretation is cautious as they do not form a coherent pattern. It is possible these represent natural variation in the sub-soil.
- 5.10 Parallel linear trends are evident throughout Area A, particularly to the east of (1) and within the area bounded by (1) and (2). They are oriented in multiple directions and most likely represent agricultural activity, possibly ridge and furrow cultivation.

Area B (Figures 6 & 7)

- 5.11 The linear ditched feature (2) extends southwards from Area A as far as the D-shaped enclosure (CL029-009131). A further series of clearly defined positive magnetic responses (10) extend eastwards towards (1) forming a rectilinear pattern. This encloses an area measuring c. 45m x 27m and may represent a further field division. Its positioning suggests that it may be associated with the same phase of activity as (1) and (2), although this is speculative.
- 5.12 A number of trends forming rectilinear patterns (11) have been identified in the vicinity of (2) and (10). It is possible that they represent habitation activity or may be associated with the field systems; this is speculative. An archaeological interpretation is cautious given the strength of the responses and they may equally represent natural variations in the sub-soil.
- 5.13 A series of clearly defined positive magnetic responses (12) are evident to the east of (10). These are consistent with several possible features captured on the topographic survey. They are indicative of ditch type features and may form part of the recorded field system (CL029-009002).
- 5.14 A series of clearly defined positive and negative curvilinear responses and trends (13) form a pattern which is consistent with the location and shape of the recorded

D-shaped enclosure (CL029-009131). The northern extent and north-eastern quadrant of this monument have been excavated and traces of the enclosure here are not visible on the survey results; much of this area is now inaccessible due to dense vegetation. The responses along the eastern side are suggestive of a ditch-bank-ditch morphology. On the south-western side, the responses are indicative of a clearly defined ditched feature with a negative response on either side. This is suggestive of a bank-ditch-bank formation. The Sites and Monuments Record describes a bank feature alone defining the eastern and southern to north-western sides of the enclosure; however, the geophysical responses suggests that there is an associated ditched feature throughout.

- 5.15 The bank and ditch responses continue eastwards from the D-shaped enclosure forming a rectilinear pattern (14). These responses are consistent with the system of embanked earthworks visible on the ground and recorded under the field system classification (CL029-009002). A poorly defined rectilinear response (15) has been identified within this area. It is oriented approximately south-west to north-east (similar to St. Brigid's Church) and encloses an area measuring c. 19m x 17.5m. An archaeological interpretation is unclear here as it coincides with the approximate location of a former excavation trench and may therefore be representative of the backfilled trench rather than archaeological remains.
- 5.16 A positive magnetic response forms a linear pattern (16) extending north-west from (13). This forms a triangular shape with the western side of the D-shaped enclosure and corresponds with a bank and fosse feature described as part of the recorded field system (CL029-009002).
- 5.17 A series of clearly defined positive and negative linear responses (17) extend southwards from south-eastern corner of the D-shaped enclosure towards St. Brigid's Church. The linear feature corresponds with the location of a substantial visible embankment which forms part of the recorded field system (CL029-009002). The responses are indicative of a bank with a parallel ditch running along its western extent. A gap to the south is consistent with the location of the excavation. The bank and ditch responses are evident continuing further southwards (18) along the western side of St. Brigid's church and extend as far as the stone wall which now surrounds St. Mary's Church (in Area C). These are not visible on the ground and the similar magnetic signature of the ditched response and its trajectory suggests that it represents a continuation of (17) which has not previously been recorded.

- 5.18 A clearly defined positive magnetic response (19) forms a linear pattern which runs southwards from (13) and parallel to (17). The response is indicative of a ditched feature and may represent a further fosse associated with (17). However, this is speculative and it may equally represent a different phase of activity.
- 5.19 To the east of St. Brigid's church, a clearly defined positive magnetic response (20) forms a linear pattern with an associated parallel negative response along the southern side. This is suggestive of a ditch and bank feature and corresponds with a 'peripheral bank' recorded under the field system classification (CL029-009002). The bank is visible on the ground and extends into Area C.
- 5.20 A series of clearly defined positive magnetic responses and trends (21) form two distinct concentric curvilinear patterns to the east of the D-shaped enclosure and west of the round tower (CL029-009010). The responses are indicative of concentric ditched features and both appear to turn eastwards in the direction of the shoreline. Unfortunately, dense vegetation to both the north and south prevented access to further investigate their full extent. However, their positioning suggests that they may have enclosed the early church remains, namely the area encompassing St. Caimin's Church and associated graveyards etc. Although the exact location is unclear, a recorded 'Excavation – miscellaneous' (CL029-009214) within this general area refers to a 'trench or ditch' which showed the presence of features dating from the reputed foundation of the site. It is possible that these concentric ditches are consistent with the location of this excavation, though further examination of the excavations would be required to determine this. It is likely that these concentric ditches represent early ecclesiastical enclosures which once demarcated the original foundation; this is further supported by the fact that the concentric ditches do not appear to respect the system of visible earthworks which suggests that they may at least be associated with a different phase of activity.
- 5.21 Immediately east of (21), an area of increased magnetic response (22) corresponds with the location of Area 5 of the earlier excavations. It is within this area that de Paor identified the location of an earthen church (CL029-009139).
- 5.22 A poorly defined curvilinear trend (23) forms a semi-circular pattern along the line of the outer enclosure ditch (21). This has a diameter of c. 5.5m and may represent the remains of a small ditched enclosure. Two circular medieval houses (CL029-009137 & CL029-009138) measuring c. 10m in diameter were excavated c. 40m to the east of this response within the area defined by (22). It is speculated that the curvilinear trend may represent features associated with the excavated medieval houses.

- 5.23 To the north-west of (23), a series of positive magnetic responses and trends form a linear pattern (24) which appears to extend eastwards from (17) before turning to follow a south-eastern trajectory. The response is suggestive of a ditched feature and may represent the remains of a former field division. Parallel linear trends indicative of ploughing or ridge and furrow cultivation to the north of (24) may also be from this phase of activity.
- 5.24 Several amorphous positive magnetic responses (25) have been identified within the vicinity of the recorded penitential station (CL029-009187). The nature of the responses is suggestive of archaeological pit-type features, although no clear pattern is evident. It is possible that they are associated with the penitential station; this is speculative.
- 5.25 Within a clearing to the east of (21), a series of clearly defined responses within an area of increased magnetic response (26) have been identified. The magnetic signature of the responses is similar to that of (6) in Area A and are suggestive of a spread of burnt material. These are of clear archaeological potential but given the small size of the area that was accessible here, it is not possible to determine their full extent and/or potential relationship with other archaeological features.
- 5.26 In the western half of Area B, a series of positive magnetic responses and trends (27) form a curvilinear pattern measuring c. 53m in diameter. The response is poorly defined and is located within an area dominated by rush vegetation. Although it is possible that these responses and trends result from natural variations, an archaeological interpretation can also be provided. It is possible that the remains of a large pitted circular enclosure have been identified here. Although cautious, this interpretation must be considered.
- 5.27 Approximately 35m east of (27), a poorly defined curvilinear trend (28) has been identified. The response is suggestive of an ephemeral ditched enclosure measuring c. 30m in diameter. An archaeological interpretation is highly cautious as the response is at the limits of instrument detection.
- 5.28 Further positive and negative curvilinear trends (29) within this half of Area B are also poorly defined. They may represent the remains of further ephemeral or plough damaged archaeological features. An archaeological interpretation is cautious but must be considered.
- 5.29 Multiple parallel linear trends which are suggestive of agricultural activity, most likely ridge and furrow cultivation, are evident in Area B, particularly to the east of (17) and

immediately north of the triangular enclosure (16). A negative linear trend (30) here may represent a former field division as it appears to delineate the extent of the agricultural trends in this location.

- 5.30 Survey was undertaken within the Saint's Graveyard (CL029-009030). The responses largely comprise modern magnetic disturbance from the extant walls and graves. Some responses of possible interest (31) were identified in the northern half of the graveyard. These amorphous positive magnetic responses are suggestive of ditch or pit-type features. However, they do not form a coherent pattern and given their location within the graveyard, an archaeological interpretation is tentative.
- 5.31 Several responses with a magnetic signature indicative of burning or burnt features (32) are found throughout Area B. Given that several metalworking areas have been excavated and recorded on Holy Island, particularly around St. Brigid's Church, it is possible that some of these responses may correspond to further metalworking areas. Although this is speculative, they are of clear archaeological potential.
- 5.32 As seen in Area A, multiple discrete positive magnetic responses (9) are evident throughout Area B. They are suggestive of isolated pit-type responses. However, an archaeological interpretation is cautious as no clear pattern is evident and they may equally represent natural variations in the sub-soil.

Area C (Figures 8 & 9)

- 5.33 The clearly defined positive magnetic response (20) identified in Area B extends to the south-west from St. Brigid's Church. This is visible as a bank on the ground and corresponds with a 'peripheral bank' recorded under the field system classification (CL029-009002). Agricultural trends to the north of this suggest that they may belong to the same phase of activity, or at least that the embankment was used to delineate the agricultural space.
- 5.34 In the area behind St. Mary's Church, a narrow strip of land leading to the holy well (CL029-009023) was clear of vegetation. Two clearly defined positive magnetic responses have been identified, the first (33) is adjacent to the boundary wall of the church and the other (34) lies immediately north of the holy well. The responses are indicative of ditched features; however, given the small size of the area available, it is not possible to ascertain their full extent and/or potential relationship with other archaeological features. The responses may be associated with a 'broad paved road' linking St Caimin's with St. Mary's (CL029-009002). This is clearly depicted on OS

6inch mapping with a curvilinear feature depicted on OS 25inch mapping. The location of (34) in particular would appear to correspond with this path.

- 5.35 A series of positive magnetic responses and trends (35) form parallel linear patterns close to the south-eastern shoreline. The responses correspond with the location of a possible feature identified on the topographic survey and are suggestive of a former trackway. This may be associated with (34) and the pathway linking St Caimin's with St. Mary's (CL029-009002). This is speculative and it is also possible that it could be associated with access to (36) below.
- 5.36 At the south-western extent of (35), a series of clearly defined responses (36) form an irregular pattern. These lie close to the shoreline surrounded by dense vegetation. Although a clear pattern is not evident, the magnetic signature is consistent with archaeological responses. It is possible that the remains of an irregularly shaped enclosure are represented here.
- 5.37 Two clearly defined responses (37) immediately west of (36) are indicative of burning. It is possible that they represent the remains of features associated with metalworking, although this is speculative. Similar responses are also evident c. 70m to the west. These are of clear archaeological potential.
- 5.38 A series of positive responses and trends (38) form a curvilinear pattern in the southern tip of Area C and may represent ephemeral archaeological features. These lie within an area of thick vegetation which has contributed to a somewhat mottled background response. An archaeological interpretation is cautious as the responses may equally be the result of natural variations in the sub-soil.
- 5.39 In the north of Area C and extending into Area B, a series of linear trends (39) form a rectilinear pattern. This is oriented north-west/south-east and encompasses an area measuring c. 12.5m x 15m. This may represent the remains of a former structure. However, an archaeological interpretation is cautious given the strength of the response and the natural background variance in this area.
- 5.40 As with Areas A and B, multiple parallel linear trends are also evident throughout Area C. These are indicative of former agricultural activity, most likely ridge and furrow cultivation.
- 5.41 Similarly, multiple discrete positive magnetic responses (9) are evident throughout Area C. An archaeological interpretation is tentative as there is no clear pattern; they may equally represent natural variations in the sub-soil.

6 Discussion & Conclusion

- 6.1 The geophysical survey has successfully identified multiple responses which are consistent with a number of the recorded archaeological monuments and visible topographic features on Holy Island. Moreover, it has succeeded in identifying further responses which provide additional layers of detail as to the morphology and extent of some of these features, in particular the D-shaped enclosure (CL029-009131) and field system (CL029-009002). The survey has also revealed a range of further responses with clear archaeological potential throughout the island, possibly relating to several phases of activity on the island.
- 6.2 Many of the recorded monuments are evident as a system of embanked earthworks and are prominent on the ground. These include the D-shaped enclosure (CL029-009131) and the range of earthworks classified under the 'field system' definition (CL029-009002). The excavations have removed much of the northern section of the D-shaped enclosure and dense vegetation prevented access to the full extent of the monument. However, the geophysical survey has revealed ditched features associated with the visible embankments that appear to continue around its full perimeter. Likewise, ditches associated with the system of earthworks which make up the field system have also been identified. These include the 'Pilgrim's Road' in the northern half and the 'peripheral bank' in the southern half of the island. Furthermore, the geophysical survey has shown that the bank running southwards through the centre of the dataset (17) extends further to the south, past St. Brigid's Church and as far as St. Mary's Church.
- 6.3 Further field systems are suggested by multiple ditched responses (2) & (10) in the northern half of the dataset. These have possible associations with the recorded field systems as the western extent (2) is approximately parallel to the 'Pilgrim's Road' and the southern limits of (10) are parallel to the banks and ditches extending eastwards from the D-shaped enclosure. Any suggestion of contemporaneity is clearly speculative, and they may equally belong to a different phase of activity which incorporated the existing earthworks. Nevertheless, it is clear that the field systems are more extensive and complex than previously recorded.
- 6.4 Two concentric ditched features in the eastern half of the dataset are of clear archaeological potential. Separated by a distance of c. 20m, they are consistent with the morphology of early ecclesiastical enclosures which typically demarcated the varying levels of sanctity associated with early church sites. Unfortunately, dense vegetation along the eastern shoreline prevented further investigation of these

features, but it is likely that they extend further towards the lake edge. These enclosures are clear evidence of an early church foundation at Holy Island. The embankment and associated ditches represented by (17) and (18) which extend southwards from the D-shaped enclosure run approximately parallel to the concentric enclosures, c. 40m to the west. Although this feature is linear rather than curvilinear, it is possible that it was associated with the concentric enclosure ditches. This is speculative, but should be considered, as it may have undergone modifications to straighten it at a later stage.

- 6.5 A positive response in the immediate vicinity of the recorded holy well (CL029-009023) may represent the remains of a further ditched feature. Again, only a small area was accessible here, and its full extent could not be determined. Its location suggests that it may form part of a later pilgrim's route linking St. Caimin's with St. Mary's; however, it may equally form part of an unrelated ditched feature.
- 6.6 Three large circular trends (5), (27) and (28) are of particular interest. Although relatively poorly defined, they may represent ephemeral or plough-damaged enclosures. Such features would not typically be associated with an ecclesiastical site, and it is possible that they belong to a different phase of activity, possibly pre-dating the ecclesiastical foundation. This is speculative but must be considered.
- 6.7 An irregular shaped enclosure has been identified in the southern tip of the island. This clearly defined response has an unusual pattern, but its magnetic signature is indicative of a ditched feature and this is of clear archaeological potential. Parallel linear trends extending to the north-east may also be associated with this possible enclosure and may constitute an approach or trackway.
- 6.8 Pit-type responses in the vicinity of the recorded penitential station (CL029-009187) may be associated with this monument, although they do not form a coherent pattern.
- 6.9 There are multiple responses indicative of burning and/or spreads of burnt material throughout the island. It is likely that the burnt material corresponds with a range of different activities at the site, potentially from different phases. With evidence for metalworking uncovered through excavation, it is certainly likely that at least some of these responses correspond with further metalworking activity. It is also possible that the remains of hearths and/or kilns are represented here.
- 6.10 Several rectilinear responses have been identified. On the whole, these are poorly defined and may represent further habitation activity, possibly associated with the

field systems. An archaeological interpretation is cautious given the strength of the responses and they may equally result from natural variations in the sub-soil.

- 6.11 Evidence for agricultural activity is present throughout Holy Island. In addition to the aforementioned field systems, multiple bodies of parallel linear trends are indicative of probable ridge and furrow cultivation. They are oriented in many different directions, possibly representing multiple phases of activity and/or adapted use of the site's many earthworks.
- 6.12 The complex of visible earthworks at Holy Island only shows part of the picture. The island has undoubtedly seen significant activity, much of it associated with its well-known ecclesiastical remains. The survey has indicated that the field systems are more extensive than previously understood, and indeed it is possible that this description of the complex of embankments and newly discovered ditches may need to be revisited. Most significant perhaps, is the discovery of the two concentric ditches which are a characteristic feature of early ecclesiastical sites, thus indicative of the formative phase of the early Church established at Holy Island. In addition, the geophysical survey has also revealed possible evidence for activity which may pre-date this phase. Although ephemeral, it is speculated that the large circular enclosures identified in the western and northern parts of the island may be associated with prehistoric activity on the island. Further investigation would be required to establish this with any certainty, but it must be considered.
- 6.13 Consultation with a licensed archaeologist and with the Department of Housing, Local Government and Heritage is recommended to establish if any additional archaeological works are required.

7 Technical Information Section

Instrumentation & Methodology

Detailed Gradiometer Survey

Detailed gradiometer survey can either be targeted across a specific area of interest or conducted as a blanket survey across an entire application area, often as a standalone methodology.

Sampling methodologies can vary but a typical survey is conducted with a sample interval of 0.25m and a traverse interval of 1m. This allows detection of potential archaeological responses. Data is often collected in grids measuring 40m x 40m, with the data displayed accordingly. A more detailed survey methodology may be applied where archaeological remains are thought likely. This can sometimes produce results with a more detailed resolution. A survey with a grid size of 20m x 20m and a traverse interval of 0.5m will provide a data set with high resolution.



Bartington GRAD 601-2

The Bartington Grad 601-2 instrument is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey very fast and effective. The sensors have a separation of 1m allowing greater sensitivity.

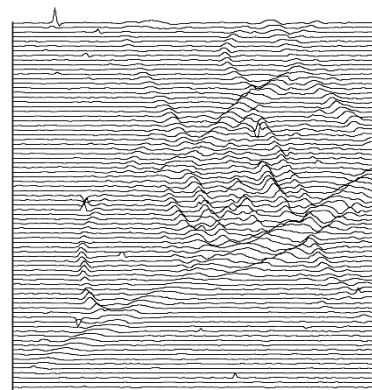


Frequent realignment of the instruments and zero drift correction ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.1nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

Gradiometer Data Display & Presentation

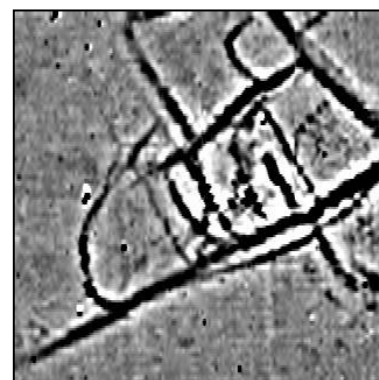
XY Trace

The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.



Greyscale*

As with dot density plots, the greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection. In the summary diagrams processed, interpolated data is presented. Raw un-interpolated data is presented in the archive drawings along with the xy-trace plots.



Interpretation

An interpretation of the data is made using many of the plots presented in the final report, in addition to examination of the raw and processed data. The project managers' knowledge and experience allows a detailed interpretation of the survey results with respect to archaeological potential.



**XY Trace and raw greyscale plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation. The archive plots are provided as PDF images upon request.*

Glossary of Interpretation Terms

Categories of responses may vary for different data sets. The list below are the most commonly used categories for describing geophysical responses, as presented in the summary interpretation diagrams.

Archaeology

This category refers to responses which are interpreted as of clear archaeological potential and are supported by further archaeological evidence such as aerial photography or excavation. The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, pits and associated features.

?Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent or archaeological cultivation activity.

?Natural

A broad response resulting from localised natural variations in the magnetic background of the sub-soil; presenting as broad amorphous responses most likely resulting from geological features.

Ferrous Response

These anomalies exhibit a typically strong magnetic response, often referred to as 'iron spikes,' and are the result of modern metal debris located within the topsoil.

Area of Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.

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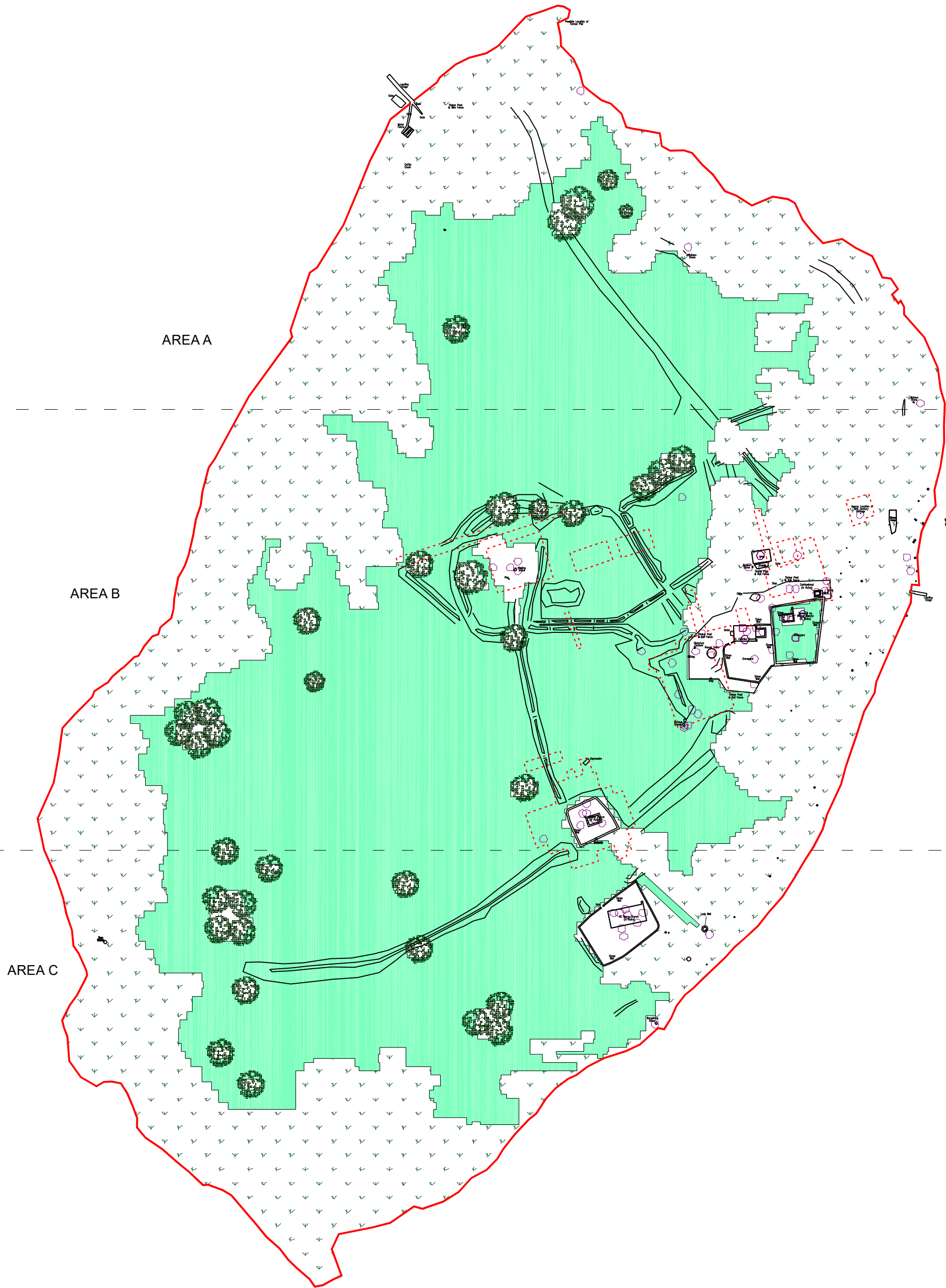
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Figure 2	Overall summary greyscale image	A3	1:2,000
Figure 3	Overall summary interpretation diagram	A3	1:2,000
Figure 4	Area A summary greyscale image	A3	1:1,000
Figure 5	Area A summary interpretation diagram	A3	1:1,000
Figure 6	Area B summary greyscale image	A3	1:1,000
Figure 7	Area B summary interpretation diagram	A3	1:1,000
Figure 8	Area C summary greyscale image	A3	1:1,000
Figure 9	Area C summary interpretation diagram	A3	1:1,000

Archive Data Supplied as a PDF Upon Request

A1.01	Raw data XY-Trace plot	A0	1:500
A1.02	Raw data greyscale image	A0	1:500



0 metres 80

Application Area

Detailed Gradiometer Survey

Inaccessible: Dense Vegetation

Former Excavations: Licence E000180

RMP

Client:

Archaeological Projects Ltd.

Project:

Geophysical Survey
Iniscaltra (Holy Island),
Lough Derg, County Clare

Title:

Site & Survey Location

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Figure: 2
Licence No.: 21R0095
Issue Date: 15.06.21



0 metres 80

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Dense Vegetation

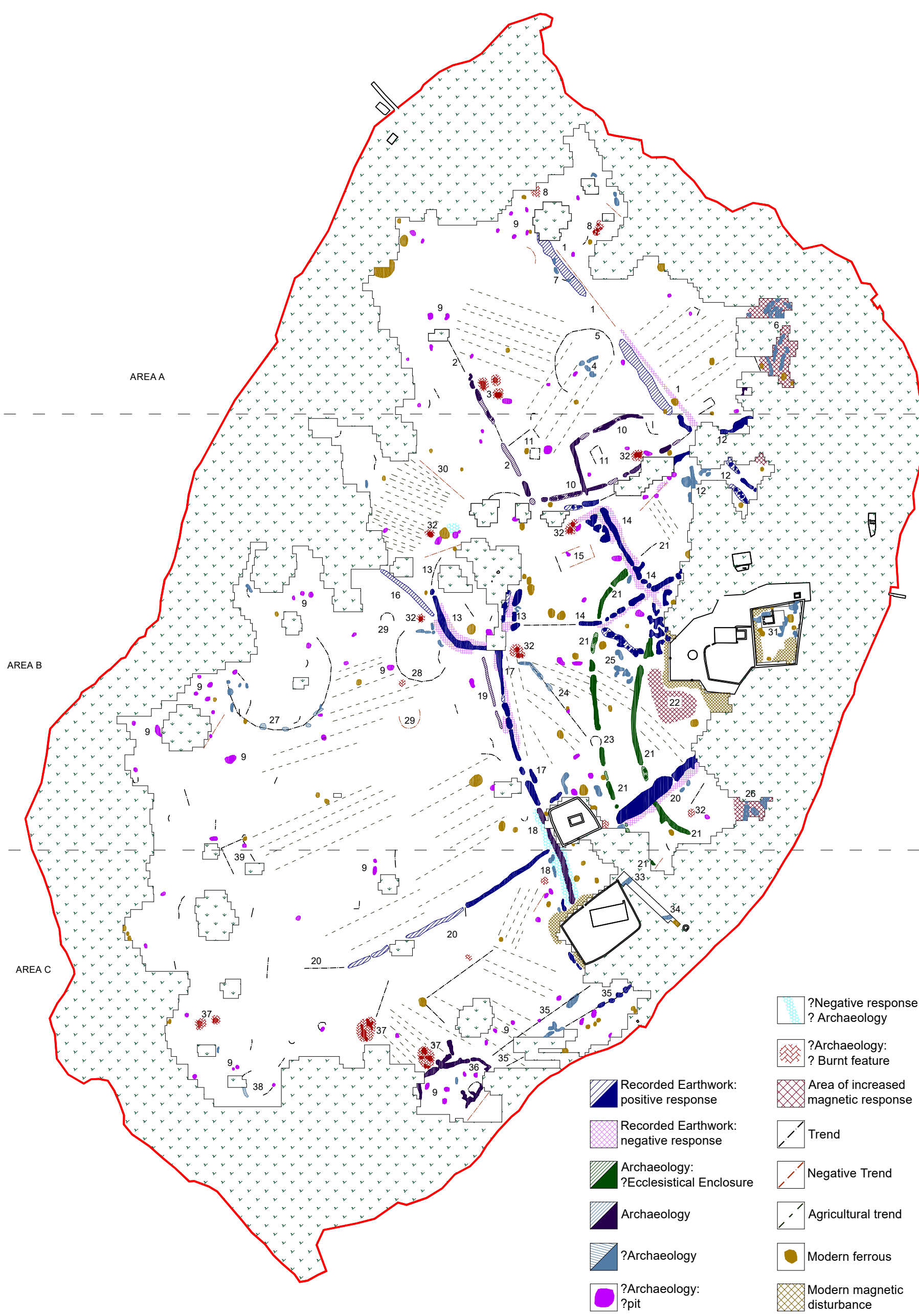
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Archaeological Projects Ltd.

Project:
Geophysical Survey
Iniscaltra (Holy Island),
Lough Derg, County Clare

Title:
Overall Summary Greyscale Image

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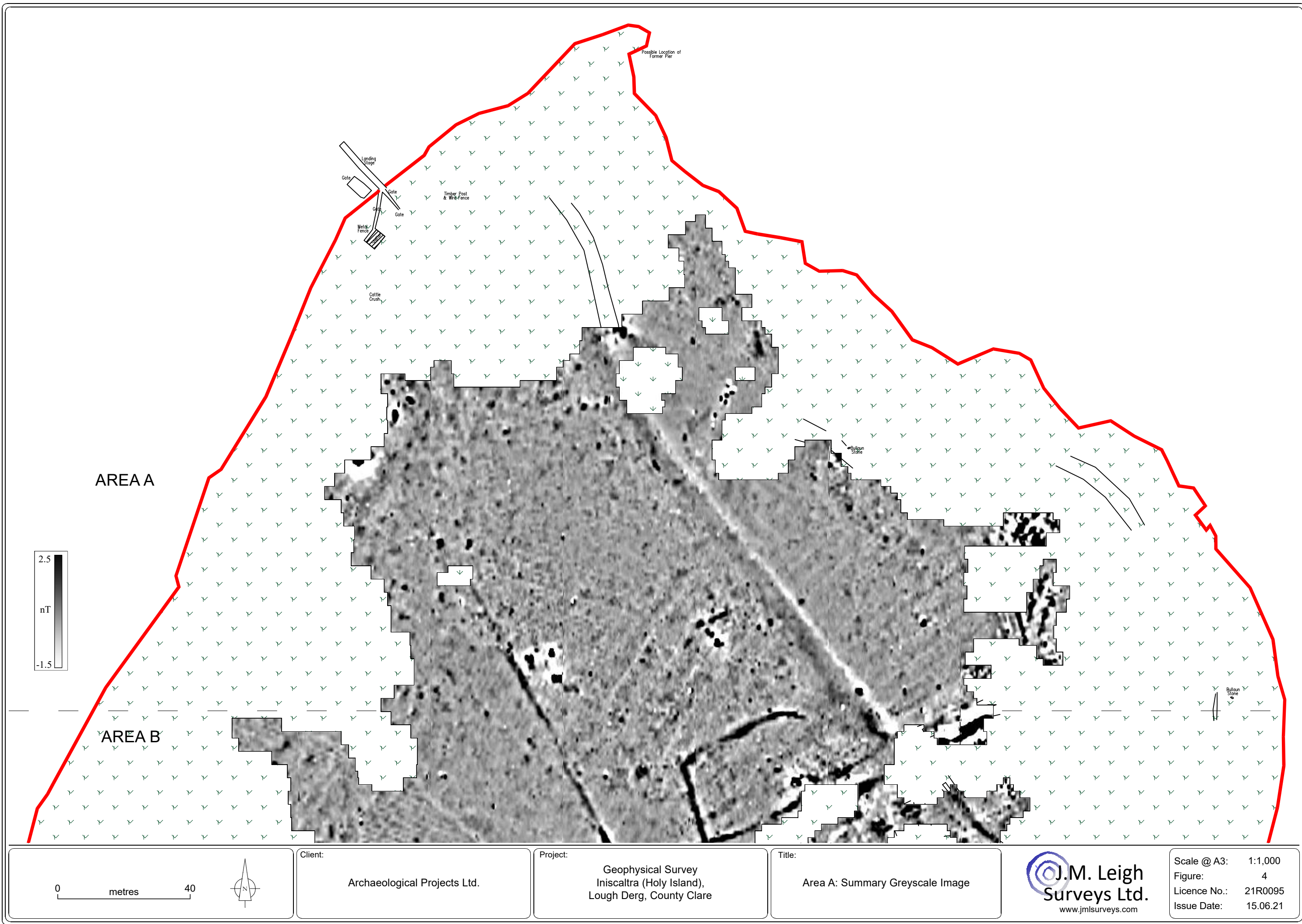
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Project:
Geophysical Survey
Iniscaltra (Holy Island),
Lough Derg, County Clare

Title:
Overall Summary Interpretation
Diagram

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Figure: 3
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Issue Date: 15.06.21



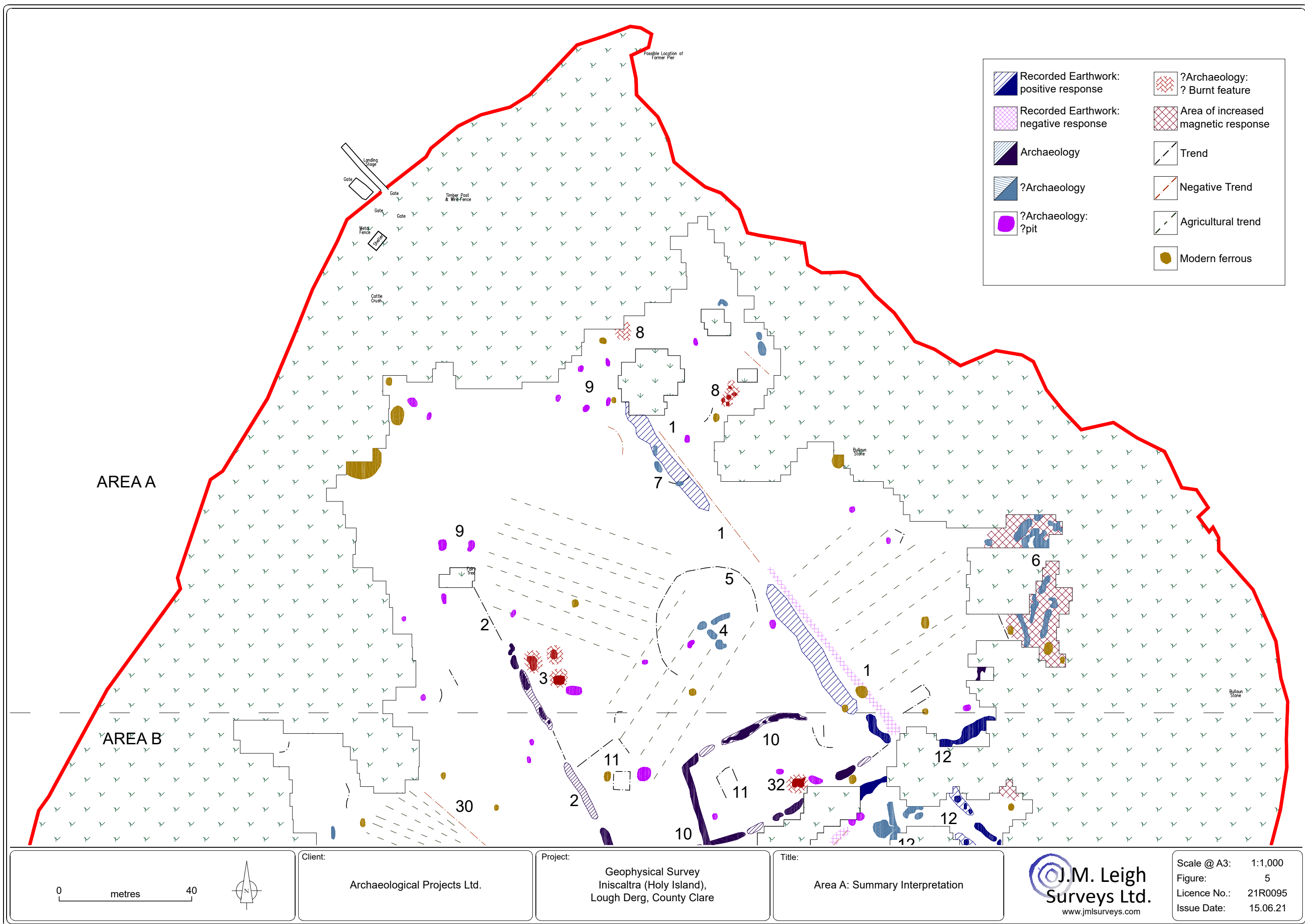
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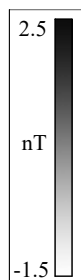
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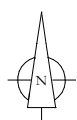
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Issue Date: 15.06.21





0 metres 40



Client:

Archaeological Projects Ltd.

Project:

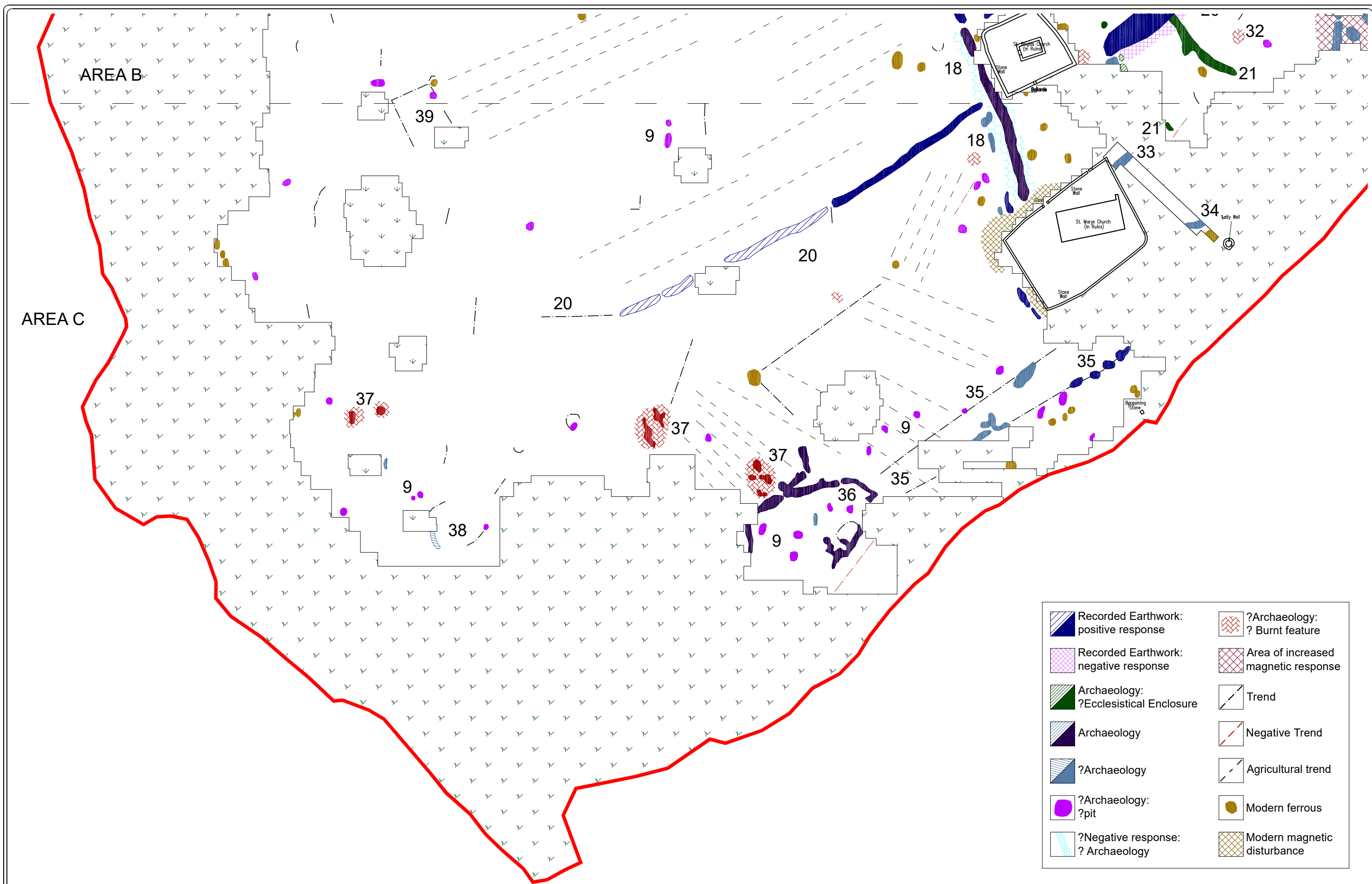
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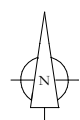
Area C: Summary Greyscale Image



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Issue Date: 15.06.21



0 metres 40



Client:

Archaeological Projects Ltd.

Project:

Geophysical Survey
Iniscaltra (Holy Island),
Lough Derg, County Clare

Title:

Area C: Summary Interpretation

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Figure: 9
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Issue Date: 15.06.21

APPENDIX 14.2

INIS CEALTRA CO. CLARE

LIDAR AND GEOPHYSICAL REPORT



VOLUME III

APPENDICES TO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024



Iniscealtra, Co. Clare: Lidar and geophysical survey

Draft report: 27/1/2022

Dr Stephen Davis, UCD School of Archaeology

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Acknowledgements

The author gratefully acknowledges the input of Joanna Leigh and Susan Curran for their geophysical survey data, Kilkenny Archaeology for their drone survey orthophotograph and digitised plans, and Claire Walsh for managing the project.

Introduction

This report presents the findings of recent lidar survey at the island of Iniscealtra, Co. Clare. Iniscealtra, also known as 'Holy Island' is located in Lough Derg and was a recent (2021) application to the Irish tentative World Heritage List (UNESCO). It is best known for its extensive monastic complex, founded in the 6th AD and comprising at least four churches, a round tower, two high crosses, and c.110 grave-slabs, many still in their original positions in the Saints' Graveyard. The island was the focus of considerable archaeological and folkloric interest in the early 20th, including a very long review by R.A.S. Macalister in 1916/1917 which includes a catalogue of the antiquities of Iniscealtra who discusses apparently extensive communication with T.J. Westropp.

The island saw extensive excavations by Liam De Paor from at least 1970-1975 (De Paor 1971; 1972; 1973; 1975; 1975; 1976). These excavations focused on a number of areas, summarised by the Heritage Council's review into unpublished excavations (https://www.heritagecouncil.ie/unpublished_excavations/section12.html#Iniscealtra).

- Site 1: Area of the Baptism Church/ St. Mary's Church, and Church Enclosure. C. 1200 AD. Area included burials, pathways, industrial activity (metalworking; bone comb manufacture) and settlement evidence (cesspit)
- Site 4: "St. Michael's Church"/ "Garraidh Mhichil". D-shaped enclosure at the summit of the island including children's burial ground. Activity dating to c. AD 1500-1800 AD.
- Site 5: Anchorite's Cell/The Confessional/The Penitential Cell-area to the north of St. Caimin's Church and the Saint's graveyard. Potentially the earliest area of activity but with multiple phases. Including some pre-Viking burials.
- Site 6: A natural hollow between sites 4 and 5. Area of pits and work surfaces. Potentially late in date.
- Site 7: Area around St. Caimin's Church and the Round Tower. Burial area including sub-Roman pottery suggesting nearby occupation.

A full archaeological report on the site is in preparation by Matthew Seaver and Aidan O'Sullivan, funded by the Royal Irish Academy.

According to the application for World Heritage Status, '[Iniscealtra] was distinctive in sustaining a large, diverse population at a time when Ireland lacked urban centres. The various enclosures with their churches not only supported a single-sex monastic element, but also other clergy, and sub-communities of all ages and genders such as labourers and craftworkers' (<https://www.worldheritageireland.ie/tentative-list/descriptions-of-received-tentative-list-applications-2021/>). To an extent this is reflected in the surveys discussed here.

Lidar data/processing

Lidar (Light Detection and Ranging) or ALS (Airborne Laser Scan) data are airborne survey data – distance measurements captured using a time of flight laser scanner mounted on an aircraft and tightly controlled spatially using a combination of differential GPS and Inertial Measurement Unit (the latter to counteract movement of the aircraft in flight). These are expressed as elevation data and comprise millions of x,y,z points which are usually interpolated to create a surface – a Digital Elevation Model or DEM.

The first surface struck by each laser pulse is usually the vegetation canopy – a model made from these ‘first returns’ is called a Digital Surface Model (DSM). Conversely the last return made from each laser pulse often represents the ground; a model made from these last returns is known as a Digital Terrain Model (DTM) or ‘bare earth model’ and is usually the desired product for archaeological prospection. Lidar data can only identify features with upstanding topographic expression so can only ever be part of a suite of methods used in archaeological prospection (e.g. incorporating aerial photography, satellite remote sensing and geophysical survey).

As lidar data represent elevation alone they require additional visualisation methods to maximise their potential. These are increasingly diverse and no one method alone is ideal. As such, a range of methods should be utilised in any such study (cf. Challis et al. 2011; Crutchley 2010; Hesse and Kokalj 2017).

- Hillshading (standard analytical hillshade) represents the simplest visualisation of all, lighting the surface from an azimuth (light direction) and elevation of the operator’s choosing. The elevation value is usually kept low (e.g. 10 degrees) to maximise the potential of identifying very low profile earthworks, while the azimuth is varied. The main weakness of this approach is that some features will be visible from one azimuth but invisible from another. It is also problematic in areas with significant topographic variation in that it can be hard to find an azimuth which does not result in a large part of the landscape being in shadow.
- Multi-direction hillshading attempts to overcome the weakness of conventional hillshading by producing a composite image of a number of (most frequently 16) hillshades. This eliminates issues of features ‘vanishing’ from certain azimuths; however, some subtle features can be ‘washed out’ using this method alone.
- SkyView Factor (cf. Zakšek et al. 2011) assesses the visibility of sky from each pixel within the elevation dataset, assigning a value between 0 (no sky visible) and 1 (all sky visible). This is particularly valuable in highlighting abrupt changes in elevation where adjacent pixels can go from very low to very high number (e.g. walls or sharp-edged pits). It is ineffectual in the case of low, subtle earthworks.
- Local Relief Modelling (not undertaken on this dataset) is a specific type of trend removal (cf. Hesse 2010) whereby a smoothed raster is subtracted from a non-smoothed raster, thereby removing the effects of topographic variation. This can be system intensive, hence it not being undertaken at this time, but works very well as a semi-transparent overlay on a multi-direction hillshade model.

The Inisceiltra data were provided by BlueSky International both as raw point clouds and as high-resolution (25 cm) bare earth DTM. While often a combination of the visualizations described above is valuable at Inisceiltra the 16-direction hillshade is the preferred format. It is possible that the data were collected at a point when there was significant vegetation coverage. Despite the quality of data provided here there is unfortunately little or no penetration of what is presumably very dense vegetation. For prospection a grid of 6 x 250 m grid squares was created, with each potential new site assigned a unique identifier of the form [grid no.].[site]. Eastings and northings were calculated in Irish Transverse Mercator. A brief list of these new features (both from lidar and geomagnetic survey) are presented in Appendix 1.

It should be stressed that lidar can only help identify features that have clear topographic variation. If a feature is ploughed flat then it will be entirely invisible to lidar and other survey methods will be necessary in order to identify such sites (e.g. aerial photography and especially geophysics).

Geomagnetic survey

Geomagnetic survey represents the most rapid and cost-effective method of geophysical survey commonly used for archaeology. Where geology is favourable this is the method of choice and given the constrained area of the island obtaining such survey data was an essential step. Details of the surveys undertaken were presented in the report by Leigh (2020), including the specifications. The data currently used in this report are rendered – this means that while the relative scale of variations remains ‘as is’, the actual magnetic values (measured in nanotesla, nT) are not available at this time.

Geomagnetic survey highlights areas that show significant magnetic variation (often enhancement) from background levels. Such features can include activity areas (e.g. areas with burning, which tends to magnetize material, metalworking or brick construction) and enclosures (cut features often show a positive magnetic response). As a method magnetometry is very sensitive to modern metal pollution, including features such as fence lines/railings which can create significant interference. If possible it is best to combine geomagnetic survey with a method that is not impacted by these factors (e.g. earth resistance or GPR).

Results

As might be expected there are features visible in the lidar that have no magnetic signature and *vice versa*. In particular some more irregular platforms of material are interpreted as belonging to spoil from the extensive excavations (e.g. 2.1; 5.1). Some features hinted at through the lidar show much stronger geophysical signatures and are certainly worthy of further archaeological testing, while some areas currently vegetated are clearly on the edge of areas that show significant magnetic disturbance.

In general, it is clear from the lidar that the site has seen significant ridge and furrow cultivation that has almost certainly impacted on the topographic expression of archaeological features and so the efficacy of lidar-based prospection. The scale of the visible ridges is variable: to the SE and NE of the D-shaped enclosure (St Michael’s Church) the ridges are broad and curving with a furrow-furrow distance of c. 4.5 m. These are most likely ridges used for cereal cultivation. To the west of the D-shaped enclosure the ridges are much narrower (<2.5 m) and may constitute later potato ridges. Similar narrow ridges are also present to the east of the island running into dense vegetation. This intense cultivation means that in a number of cases the geophysical survey identifies features that are not visible in the lidar data.

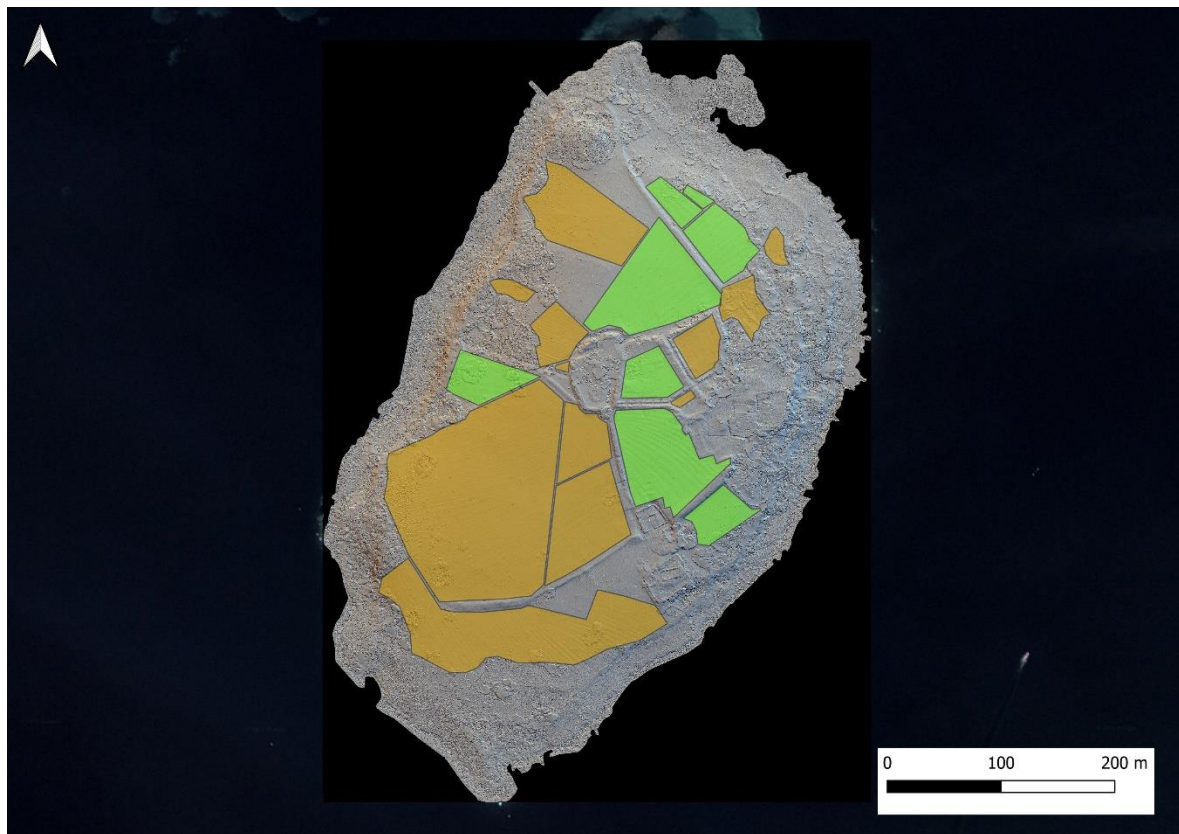


Fig. 1. Iniscealtra ridge and furrow cultivation. Narrow ridges (c. 2.5 m) in brown with wide ridges (3.5-4.5 m) in green.

Round tower area

The immediate area of the round tower CL029-009010- was not subject to geomagnetic survey, and while there are clear rectilinear features present in the lidar data these most likely relate to historic excavations (excavation Area V). West of the round tower are two arcing ditches (5.7 – Figs 2-4), running almost parallel to each other in an approximately N-S direction and separated by between 16-30 m, with a maximum extent of over 160 m. The innermost of these ditches was clipped by historic excavations (Site 7, Area V - Fig. 4); however, the outermost enclosure was beyond the limits of these excavations, although trenches at Area III ran almost parallel and within centimetres of the ditch cut for almost 20 m. The northern and eastern termini of the two enclosure ditches are hidden beneath vegetation, but the outermost ditch appears to terminate at the western boundary of a D-shaped enclosure or field marked as CL029-009002 – Field System. This was partially excavated as Area IV, Site 6.

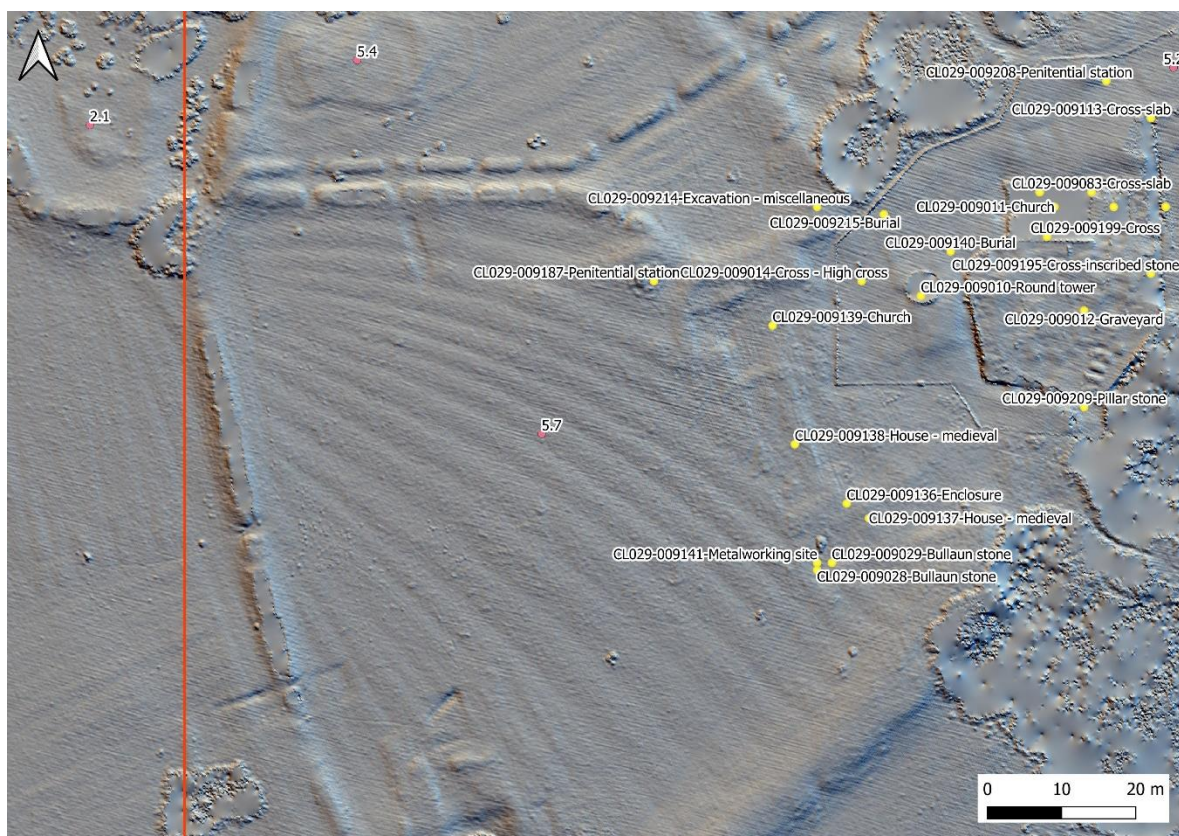


Fig. 2. Area of 5.7, the substantial bivallate enclosure. Very slight N-S ditch visible in 16-direction hillshade

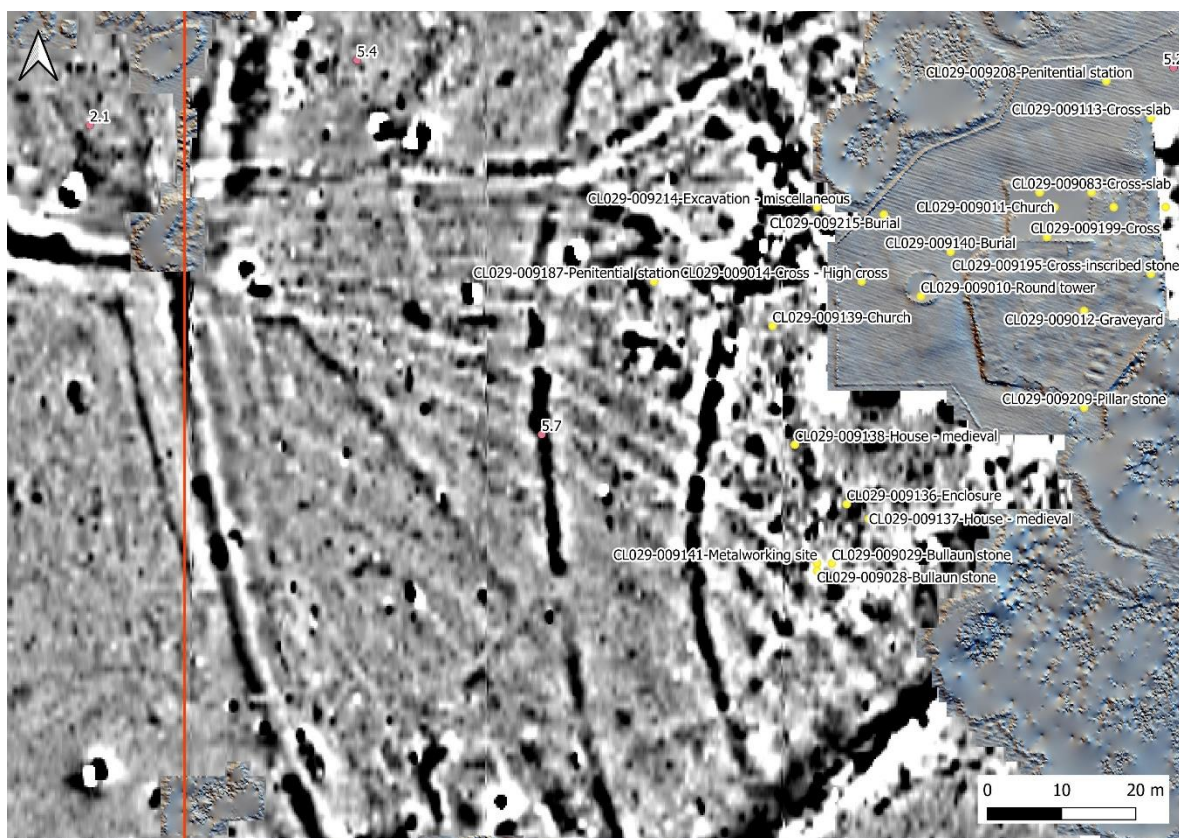


Fig. 3. Geomagnetic survey of area shown in Fig. 2 showing parallel curving ditches.



Fig. 4. Semi-transparent excavation plan overlain on geomagnetic data, showing intersection between excavation area and inner ditch

The northwestern portion of this D-shaped enclosure is visible in both lidar and geophysics but extends beyond the excavation area. It seems likely that this main ecclesiastical enclosure uses the edge of the island as its SE boundary and operates almost like a cliff-edge fort.

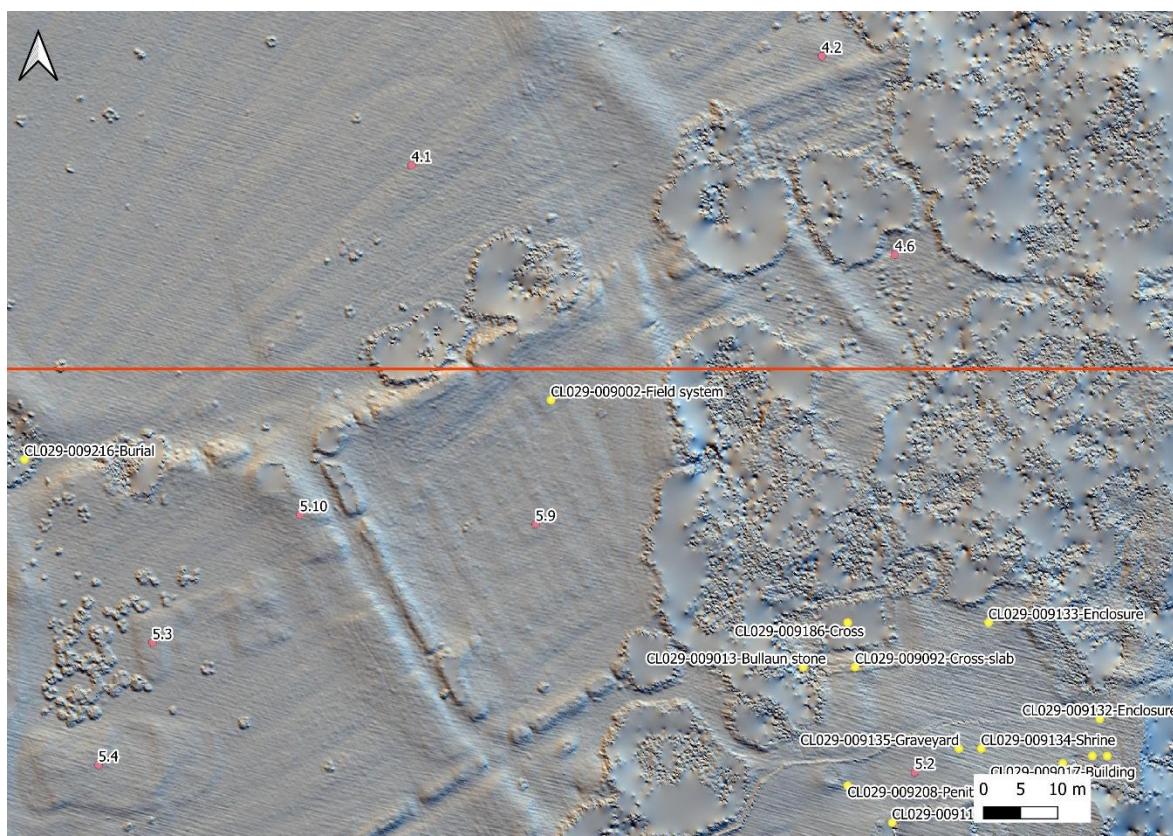


Fig. 5. 'D-shaped enclosure' 4.1 – 16 direction hillshade.

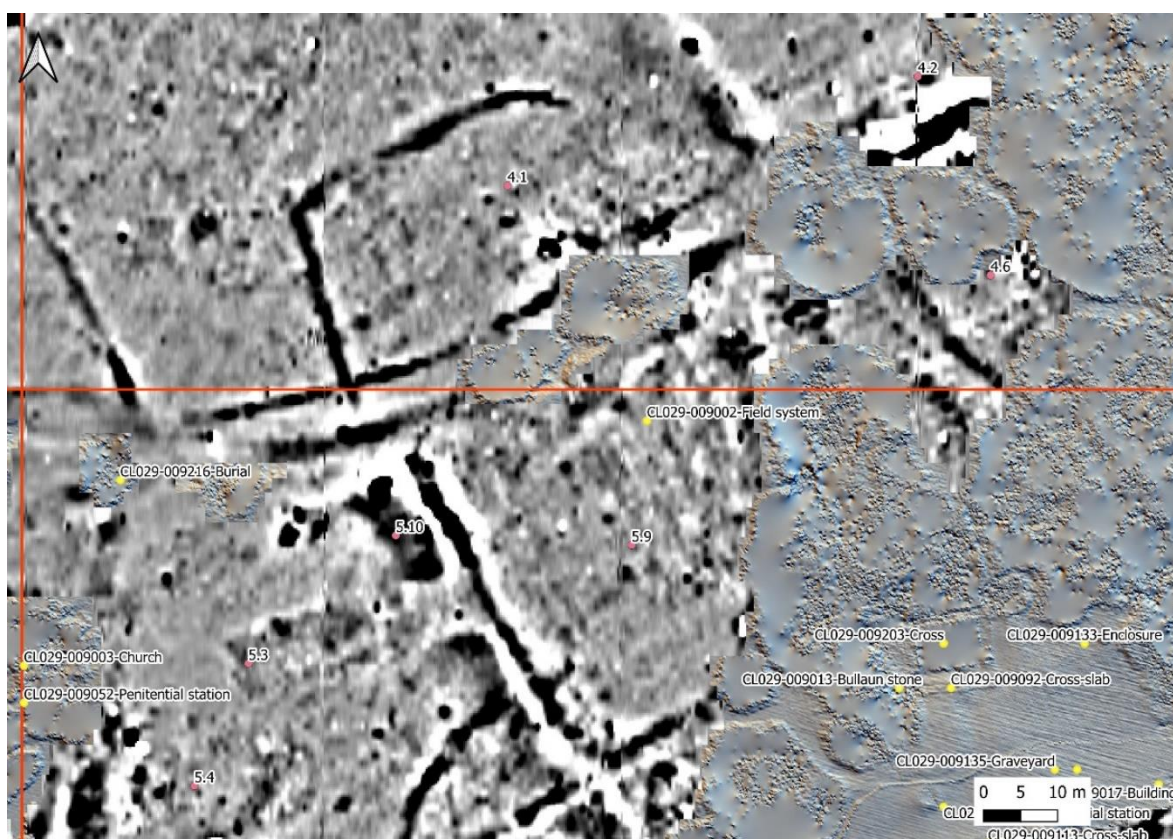


Fig. 6. 'D-shaped enclosure' 4.1 geomagnetic survey



Fig. 7. Area as for Fig. 5-6, excavated features over 16-direction hillshade.

To the west of the roadway and D-shaped enclosure is a slightly raised embankment. In part this has been cut by Excavation Area IV, but the northwestern portion comprises a tripartite geophysical anomaly that may represent a building (5.10 – Fig 6).

The area around church CL029-009015- (Excavation Area V) includes a great deal of magnetic disturbance, but the window of geophysics at this location is not enough to be able to clearly identify trends. More survey in this area is recommended

Eastern section: between CL029-009019- and CL029-009024-

A clear elevated platform exists in this section of the island, most likely a palaeoshoreline (4.5 – Fig. 8) but offering an area which may have been exploited archaeologically. A small section of geophysical survey here resulted in some very strong magnetic responses suggesting that this area was a focus of significant activity (Fig. 9). However, the current survey window is too small for meaningful interpretation. Further geophysical survey in this location (southwest of 4.5) is strongly recommended.

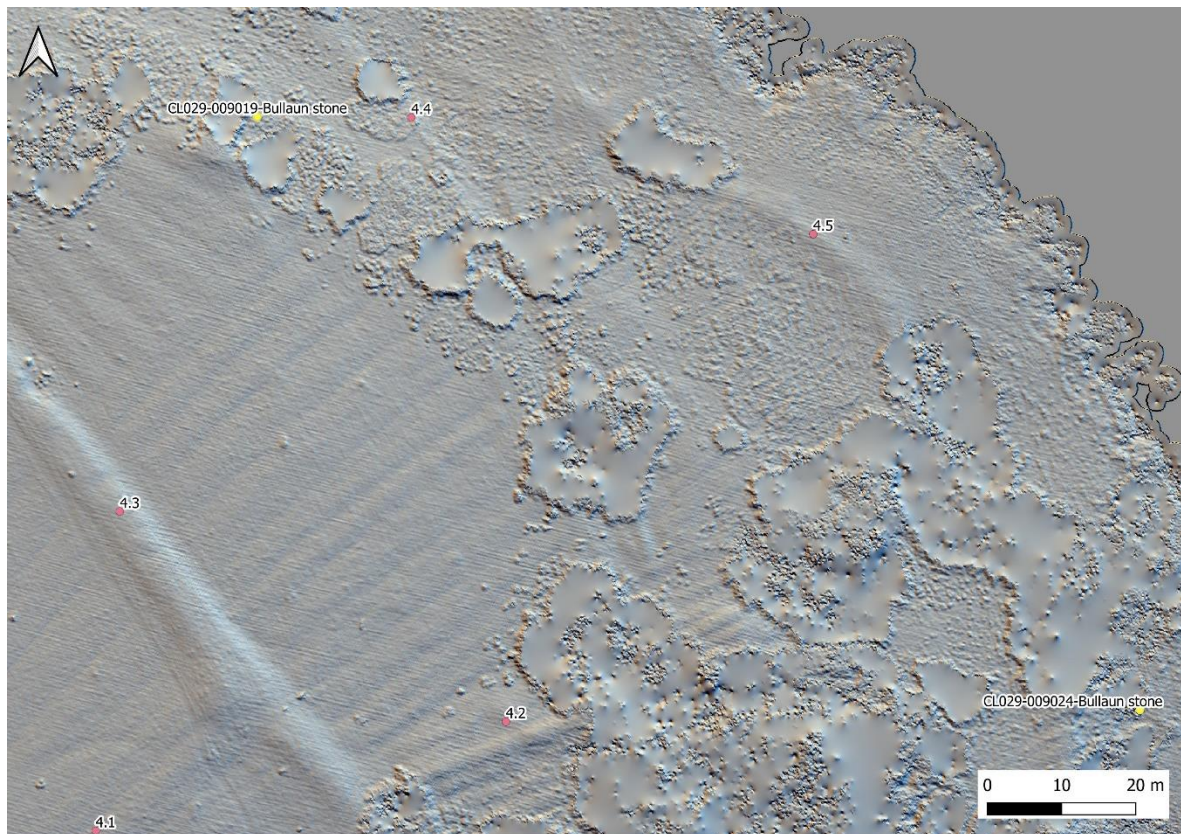


Fig. 8. 16-direction hillshade, Iniscealtra – eastern shoreline

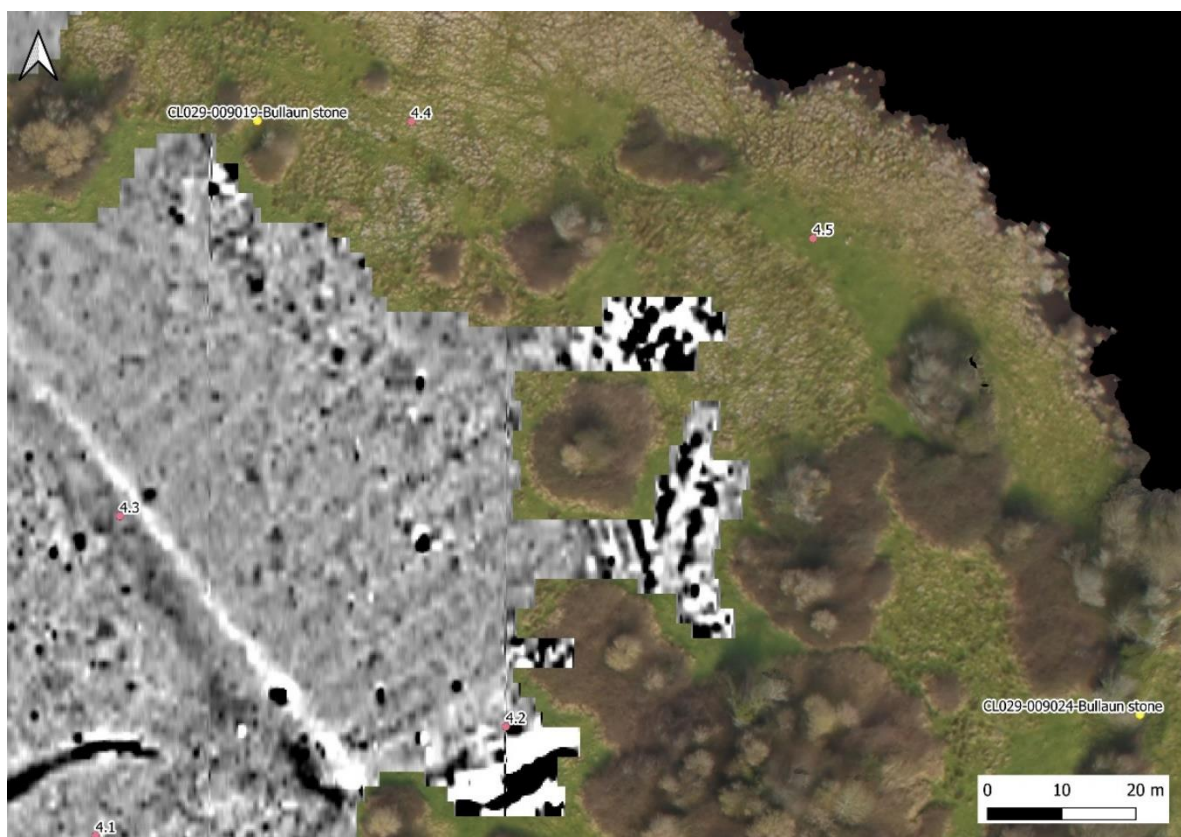


Fig. 9. Iniscealtra – eastern shoreline, geomagnetic data showing strong magnetic responses.

South of this location, to the east of field system CL029-009002- are further significant geomagnetic anomalies (Fig. 11). These relate to areas that have clearly seen intensive ridge and furrow cultivation (Fig. 10) but are currently under increasing vegetation (4.6). This area is almost certainly archaeologically significant but difficult to prospect given its current vegetation cover. It is possible that the eastern features identified relate to Macalister's (1916-17, 109) landing stage area, although this is difficult to accurately locate from his map.



Fig. 10. D-shaped enclosure 4.1 and ridge and furrow at 4.6. 16-direction hillshade.

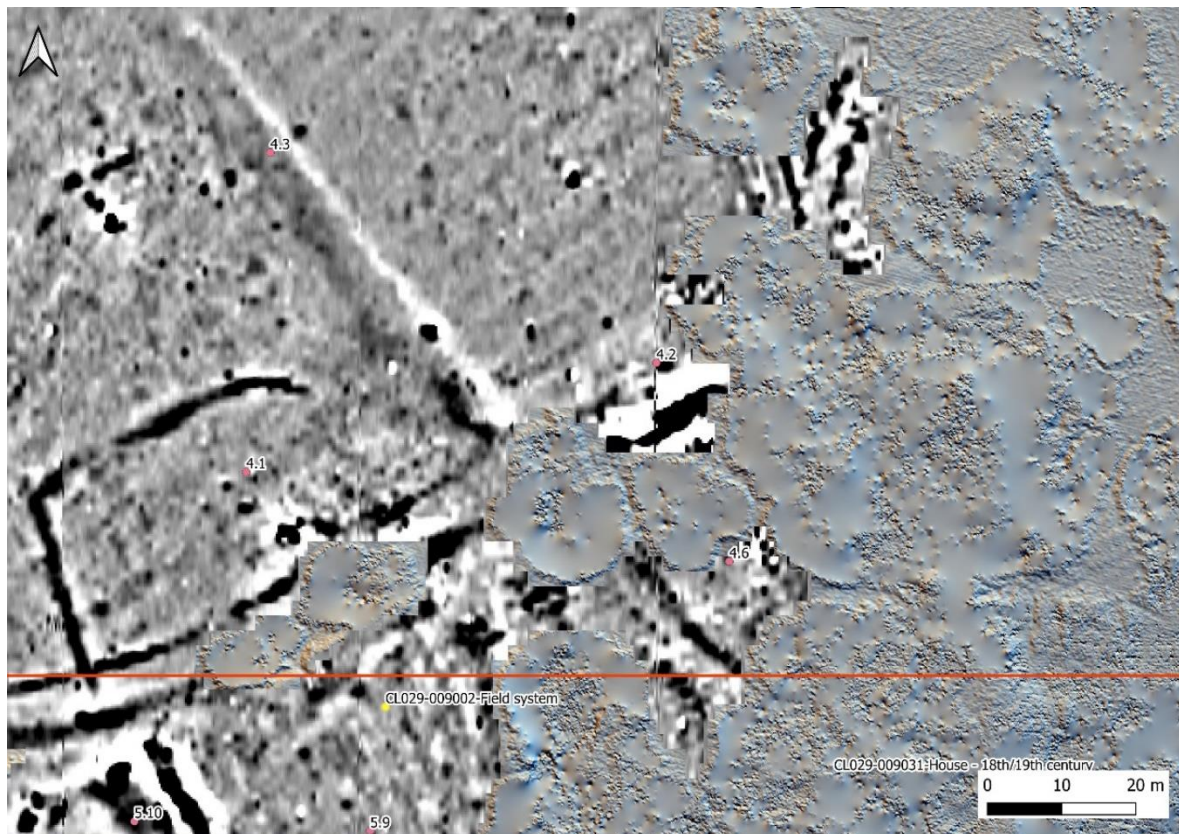


Fig. 11. D-shaped enclosure 4.1 and ridge and furrow/strong magnetic responses at 4.6.

Southern area, SW of CL029-009022-

This low-lying area shows suggestions of small-scale land division (6.1 – Fig. 12). While this is not clearly reflected in the geophysical data, the terrace edge is clearly visible as a strong and segmented positive magnetic response (this apparent segmentation might relate to the clearly visible ridge and furrow cultivation), with a weaker linear response located between 7-10 m further inland of this. Further southeast is a clear and in some places strongly magnetic oval enclosure (3.2 – Fig. 14-15) and associated D-shaped field to the NW. The former is, with hindsight, evident in the lidar data. This enclosure complex likely extends to the southwest but the vegetation clearly impedes further survey in this location.

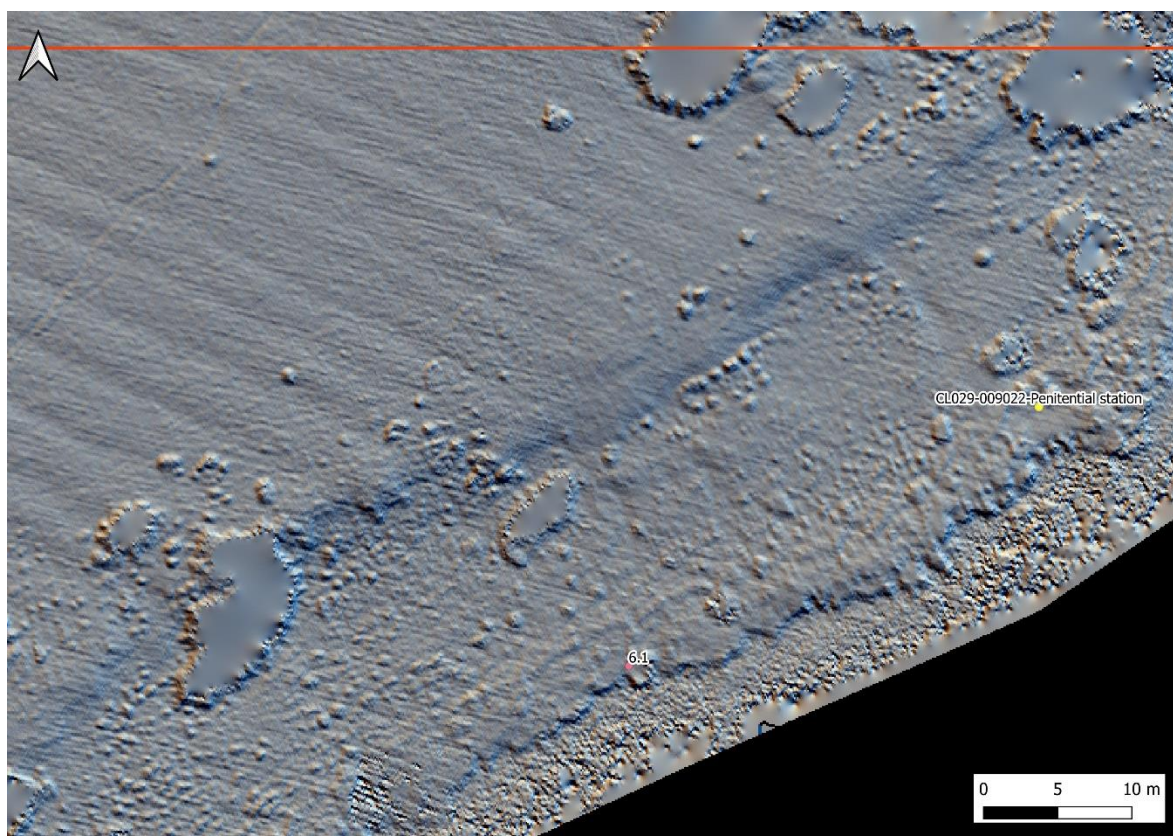


Fig. 12. Southern area showing possible land division at 6.1. 16-direction hillshade.

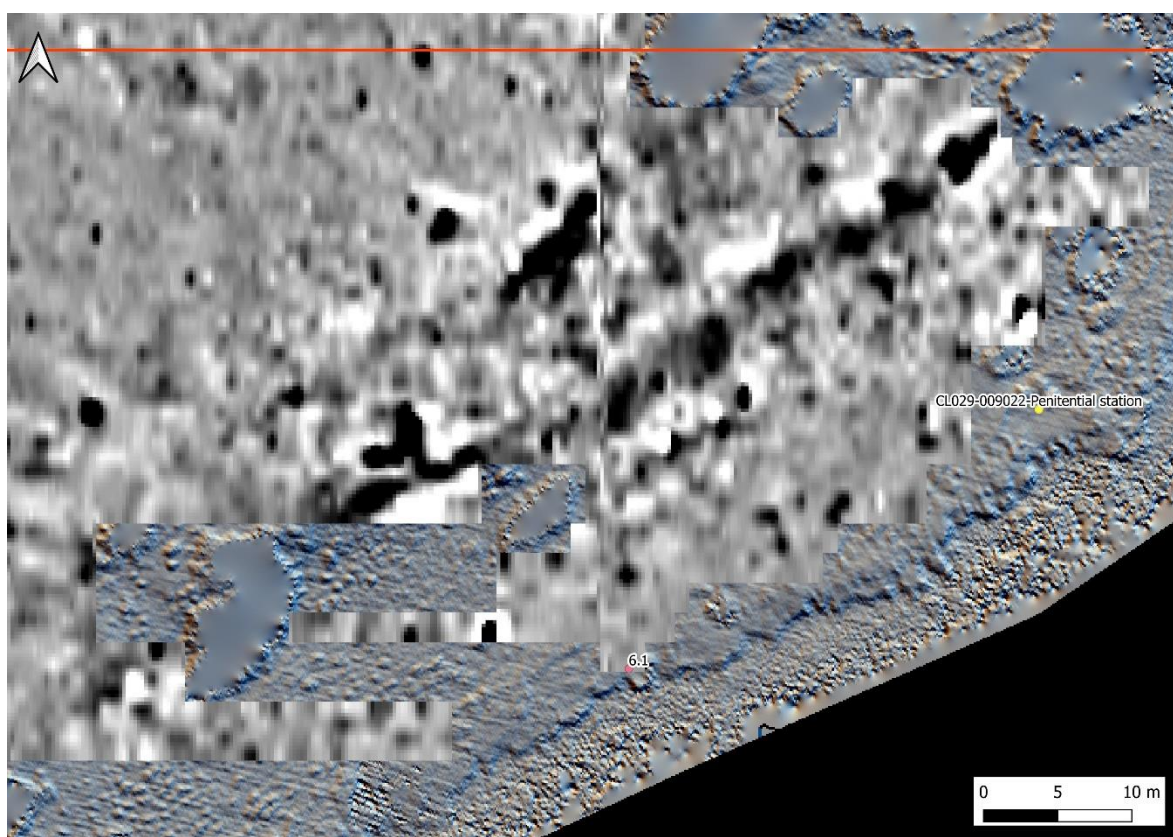


Fig. 13. Southern area geomagnetic data showing enhanced signal at and removed from terrace edge.

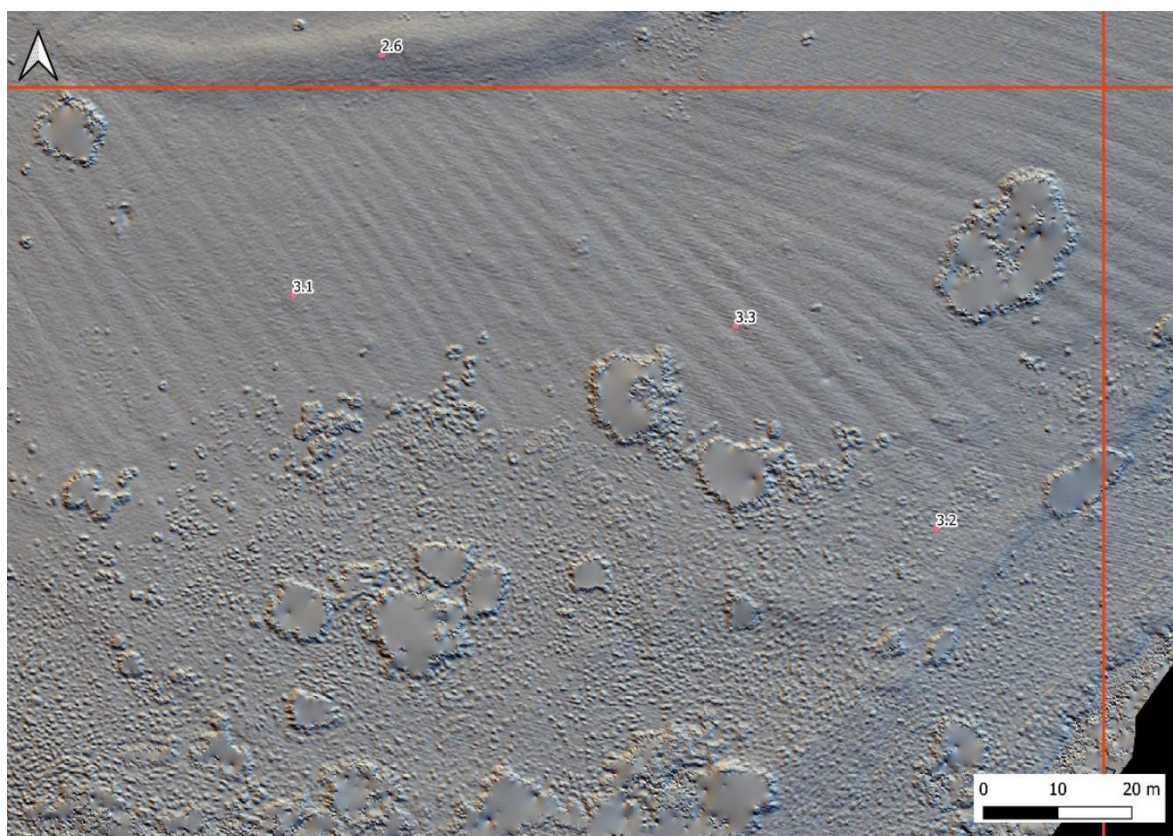


Fig. 14. Enclosure features in southwest of survey area. 16-direction hillshade.

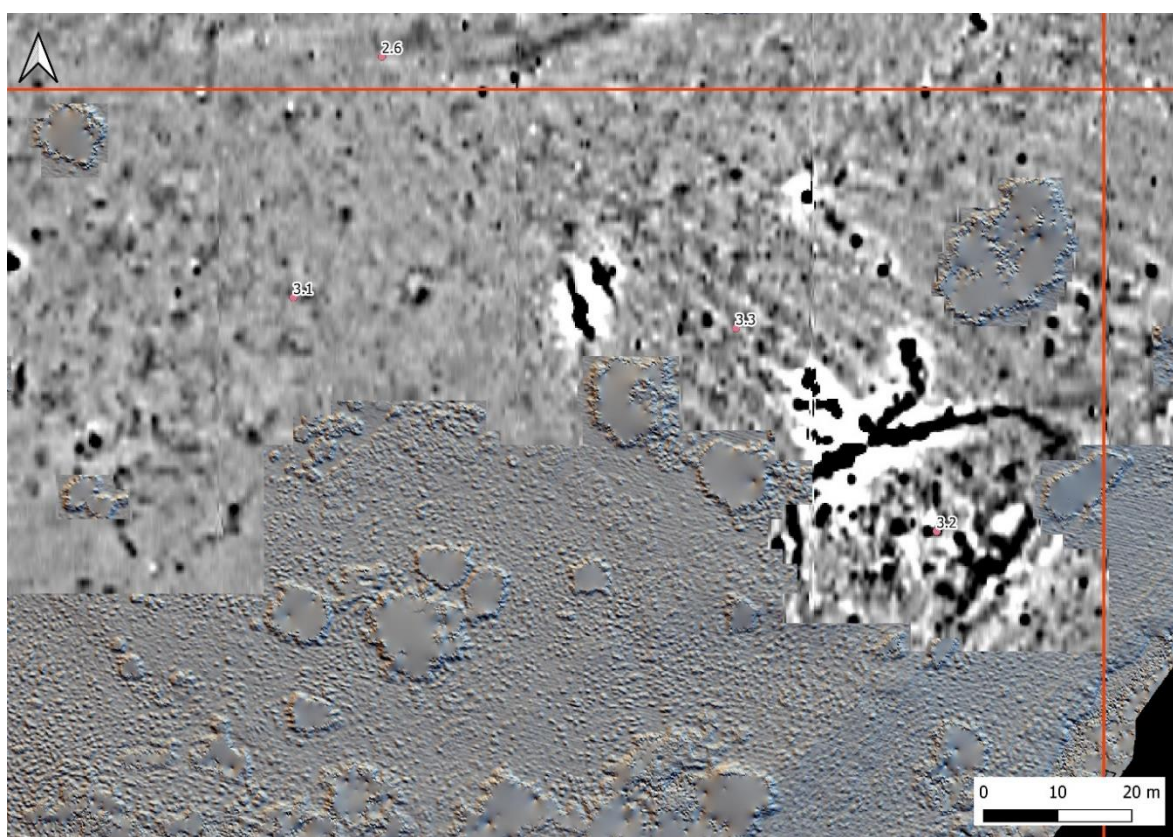


Fig. 15. Enclosure features in southwest of survey area. Geomagnetic survey.

Recommendations

Several recommendations are made for future work, both essential and optional:

Data compilation

It is important for future management and research that all data relating to Iniscealtra be compiled in the correct format and held as a single archive. At present several of these datasets are in suboptimal form: the site plans as provided are in raster rather than vector format and not georeferenced; the geomagnetic survey data while undoubtedly of significant use is provided as a rendered greyscale image rather than holding the actual nanotesla (nT) values. This has implications with regard to the utility of these datasets and the ability to publish them: geophysical images such as those show in this report would usually be accompanied by a nT ramp. These are all simple problems to rectify but it is important that this happens.

In light of the new surveys, especially the geophysical survey, a review of previously excavated material would also be advised. In particular it is evident that the significance of the innermost ditch of the ecclesiastical enclosure is likely not to have been fully appreciated given that only 12 m of this was evident within Area V. The new surveys will greatly enhance our understanding of the interrelationships between excavated features, and perhaps help with understanding the phasing of the complex.

Vegetation clearance and additional survey

There are areas where further survey is recommended, some of which might also need a degree of vegetation clearance. In the SW of the island (Fig. 14) are two previously undescribed enclosure features which may continue SW of the current survey area. Similarly, in Figs. 10 and 11, and Figs. 8 and 9 there are clear archaeological features where further survey is currently impeded by vegetation cover. The strength of magnetic response evident in the sections of these locations where survey was possible hint at significant and thus far unrecorded archaeological features where clearance followed by additional geophysical survey would be of enormous value. Some small parts of Area V (between Sites 5 and 7) also currently remain unsurveyed. The exceptionally strong magnetic responses in some of the area within the enclosure might necessitate the use of a non-magnetic survey method (e.g. earth resistance; GPR). In some locations (e.g. within the ecclesiastical enclosure) this would be exceptionally valuable.

Test excavation

There are features identified within these surveys that would benefit from some test excavation. While the inner ditch of the main ecclesiastical enclosure has been cut by excavations in Area V, the outermost ditch has not been investigated, nor the intervening area. A small cutting across the outer ditch, or potentially across both ditch sections would be important for understanding the phasing of the site and whether this double-ditch form represents a single construction phase. The significance of the eastern part of the island (4.1-4.5) is difficult to fully appreciate without further survey. The ditch at 4.1 could be explored further but it seems likely that further significant archaeology exists between 4.2 and 4.5 and will become clearer post-survey. It would also be beneficial to test Sites 3.2 and 3.3: in form these are similar to the D-shaped field system located north of Area V and may prove to be contemporary features.

Conclusions

The lidar and especially the geophysical survey have demonstrated the presence of additional activity areas beyond those excavated by De Paor that would benefit from further investigation. In particular there are two areas peripheral to the main ecclesiastical complex – one to the east the other to the southwest – that appear to be archaeologically significant although difficult to fully explore owing to current vegetation. As a first priority vegetation in these areas should be cleared and geophysical survey completed; a secondary objective might be small-scale targeted test excavation focused on trying to identify the date and function of these newly identified areas. These data (when provided in the correct format) should be integrated into a final site GIS that will assist in the future management of Inisceiltra.

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Appendix 1. Potential archaeological features identified through lidar and geophysical survey

Code	Class	Description	Easting	Northing
1.1	Field system	Defined by interruption in NW-SE ridge and furrow. Later disturbance. Nothing clear in mag	569667	685150
2.1	Platform	Slight raised area within enclosure. Possible spoil? 10 x 11.7 m	569717	685071
2.2	Mound	Small mound, 2.1 m diameter, max 0.2 m height. Not apparent in magnetometry but area of positive responses	569607	685040
2.3	Enclosure	Weakly defined enclosure, max 9 m diameter. Hints of this in magnetometry data. Possibly prehistoric?	569702	685005
2.4	Boundary	Slight ditched boundary running N-S. May pre-date southern field as ridge and furrow continues on same orientation	569680	684961
2.5	Boundary	Running NW-SE for 50 m, 0.2 m high. Possible lynchet. Visible in mag as anomaly to NW.	569685	685079
2.6	Boundary	Raised boundary, running E-W 70 m then curving to NE. Possible lynchet, raised slightly to N. W section not visible in geophysics	569632	684888
3.1	Mound	Slight mound, not visible in geophysics. Magnetic anomalies present but 15 m to east	569620	684855
3.2	Enclosure	Oval enclosure not visible in lidar but strongly magnetic. Full NW-SE extent not clear but at least 38 m x 23 m	569707	684824
3.3	Enclosure	D-shaped enclosure visible in magnetometry, 38 x 41 m	569680	684851
4.1	Enclosure	D-shaped enclosure, 39.8 x 32.5 m. Clearly visible in magnetic data	569795	685161
4.2	Boundary	Raised boundary running NE-SW. Strong positive magnetic linear not quite parallel to SE.	569851	685175
4.3	Boundary	Possible lynchet running c. 150 m NW-SE. Drop of c. 1 m to NE side.	569798	685204
4.4	Boundary	Continuing from mage signal to SW, ditched boundary potentially isolating eastern plateau	569838	685257
4.5	Boundary	Clearly defined boundary to east of field system. Possible terrace edge	569892	685241
4.6	Boundary	Curving boundary visible in geophysics arcing to NE. Possibly an enclosure	569860	685149
5.1	Platform	Curving anomaly running W-S. Not visible in geophysics, possible spoil	569777	684936
5.2	Platform	Curving raised area north of geophysics. Possible spoil?	569863	685079

Code	Class	Description	Easting	Northing
5.3	Platform	Raised rectangular area, 21 x 8.5 m. Visible in geophysics as weak magnetic anomaly	569760	685096
5.4	Platform	Raised irregular area, surrounded by ditch. 26 x 12.5 m. Eastern curve visible in geophysics	569753	685080
5.5	Platform	Irregular raised area curving from W to S. Possible spoil? Quiet in mag	569761	684919
5.6	Enclosure	Rectangular enclosure west of CL029-009016- 4.5 x 5.5 m. Highly magnetic area	569874	685047
5.7	Enclosure	Very weak signature of ecclesiastical enclosure as visible in magnetometry data	569778	685029
5.8	Enclosure	Small enclosure around CL029-009016-. 2.8 m diameter	569868	685048
5.9	Enclosure	Small enclosure within field, d= 5.5 m. Not apparent in magnetometry	569812	685112
5.10	Building	Rectangular tripartite structure, 14.5 x 3.9 m. Platform in lidar, clearly visible in magnetometry. Possible house	569780	685114
5.11	Boundary	Slight ditched field boundary E-W. Not visible in geophysics	569825	684968
6.1	Settlement	Possible settlement plots parallel to lake edge. Not clearly visible in geophysics but linear magnetic anomaly to north, probable shoreline	569772	684842

APPENDIX 14.3

INIS CEALTRA CO. CLARE

UNDERWATER ARCHAEOLOGICAL IMPACT ASSESSMENT



VOLUME III

APPENDICES TO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024



Inis Cealtra, Co. Clare
Underwater Archaeological Impact Assessment
21D0019, 21R0025





Inis Cealtra, Co. Clare
Underwater Archaeological Impact Assessment
21D0019, 21R0025

Draft for review

23/06/2021

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Clare County Council

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Abbreviations

ADCO	Archaeological Diving Company Ltd
AIA	Archaeological Impact Assessment
DCHG	Department of Culture, Heritage and the Gaeltacht
DHLGH	Department of Housing, Local Government and Heritage
E	Easting
EIS	Environmental Impact Statement
ITM	Irish Transverse Mercator
MHW	Mean High Water
MWP	Malachy Walsh and Partners
N	Northing
NGR	National Grid Reference
NIAH	National Inventory of Architectural Heritage
OD	Ordnance Datum
SMR	Sites and Monuments Record

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- Plate 31: Iron nails x2 and copper nail x1 recovered from lake bed off the bow of log boat Canoe No. 3.
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- Plate 33: Underwater view showing timber post or plank lying loose on the lake bed.
- Plate 34: Underwater view showing end-shot of timber post/plank.
- Plate 35: Screen grab from underwater video at location of Canoe No. 2 in 2021 showing the grain of the timber running across the picture.
- Plate 36: Selection of objects recovered from metal detection along the north shore.
- Plate 37: Three pieces of leaded object with alloy sheathing, recovered beside the northwest pier.

Executive Summary

Subject: Holy Island, Inis Cealtra, Co.Clare
Location: Iniscaltra townland, Co. Tipperary
ITM: 569675E 685331N
Licences: 21D0019, 21R0025
Planning ref: n/a

Introduction

An Underwater Archaeological Impact Assessment (UAIA) was carried out by the Archaeological Diving Company Ltd (ADCO) along the north shore of Inis Cealtra/Holy Island, Co. Clare on Lough Derg, where Clare County Council's Inis Cealtra (Holy Island) Visitor Experience Project is proposing to upgrade the mooring facility either by renewing the existing pier on the northwest shore, or by constructing anew off the north shore.

Site work was completed on 05/05/2021.

Receiving environment

The archaeological potential of Inis Cealtra is well known as an important place throughout the middle ages. Some insight was gained of the underwater environment in 2011 with the recording of several log boats off the northern shoreline.

2021 Underwater archaeological survey

The 2021 underwater archaeological survey was completed by ADCO on the 5th May. Site work focused on the shoreline extending from the existing pier on the northwest shore to the area of the possible new landing off the north shore. Full access to the lakebed and project area was possible and no constraints were encountered. The survey included a walkover inspection of the shoreline, a drone survey, a non-disturbance underwater inspection extending between 50 m and 98 m off shore and a metal-detector survey focused on the north shore area.

The scarp of a former shoreline is retained on the landward side of the island. The current shoreline is created in a lowlying area of marsh.

The drone survey highlights one feature on the current shoreline that might have served as a constructed landing. The feature is located off the north shore at ITM 569931E 685225N and forms a slight and narrow indent, indicative of a landing.

The northwest pier is a concrete-built structure that has been extended.

The soft silts that make up much of the lakebed close inshore retain excellent holding capacity for cultural heritage remains but only a single timber post was observed standing proud of the lakebed, and is located off the North-northwest shoreline.

The location of one of the log boats was confirmed, and the guide-lines used to record it in 2011 remain in place (2011, Canoe No. 3). Three nails were recovered from the silt outside the log boat.

The location of a second possible log boat is suggested to be that of a tree trunk (2011 Canoe No. 2).

The two other log boat locations recorded in 2011 lay outside (east of) the survey area (2011, Canoe Nos 1, 4).

The metal-detection survey recorded a series of objects along the shoreline, which are modern. Three pieces of a leaded object were also recovered beside the northwest pier, and it is likely that these pieces are not of historic interest.

Discussion

In contrast to the extensive land-based excavations conducted on Inis Cealtra, there have been only two archaeological assessments under water, one in 2011 and the other in 2021. On both occasions, archaeological remains have been recorded, attesting to the high archaeological potential of the underwater environment at Holy Island. The report of 2011 records the presence of log boats off the north-eastern shore of the island. Over the course of one day on site, the 2021 inspection has: considered the nature of the pier off the northwest shore; recorded a timber post standing in isolation to the north; confirmed the identification of Canoe No. 3 as a log boat, qualified the potential identification of No. 2 as a tree trunk, and identified a new landing area on the north shore. The metal-detector survey in turn has shown the presence of objects although none of those identified are clearly early.

The presence of a log boat and a landing area off the north shore suggests strongly that this was a preferred landing area in the past. The presence of iron nails associated with Canoe No. 3 indicates that this log boat most likely belongs to the historic period rather than to prehistory. The possibility that the log boat was contemporary with the monastic centre exists.

The 2011 report refers to the other log boats recorded further east as being on rocky substrate, while Canoe No. 3 lies in soft silt. The area to the west of Canoe No. 3 is also one of soft silt where one can expect the holding content to be very good for the preservation of objects that might be buried in it. This area is where the option for a new landing area is being proposed.

Impact assessment

The proposed impacts are associated with either upgrading the northwest pier or constructing a new landing off the northern shoreline.

It is likely that to upgrade the northwest pier it will be necessary to largely remove and/or bury the existing structure as the upgrade will require raising the deck level and including a breakwater feature to protect against foul weather.

The location proposed for the construction of a new landing off the north shore lies west of the recorded log boat (Canoe No. 3) and of the landing place feature identified in

2021. However, the proposed new landing is very close to these two exposed archaeological features. The archaeological potential of the area is high as witnessed by both features. The archaeological potential is also qualified by the underlying soft mud substrate in this area, which presents an ideal holding content for archaeological features that might remain buried in the lake bed.

Recommendations

The proposal to upgrade the existing northwest landing is likely to encounter less archaeological risk than to construct a new landing off the north shore. For this reason, it is recommended that consideration be given to upgrading the existing pier.

Given the archaeological potential of the island, further underwater archaeological input is recommended in advance of construction.

Should the project proceed with upgrading the northwest pier, this would include:

- Additional survey of the existing northwest pier and land area, to present a permanent record of the pier before it is transformed.
- Underwater excavation at the proposed construction impact locations (e.g. pile locations), using hand-operated suction dredges to test the potential of the substrate to retain archaeological features.

Should the project proceed with constructing a new landing off the north shore, further underwater archaeological input in advance of construction would include:

- Detailed underwater survey of the construction footprint.
- Underwater excavation using hand-operated suction dredges to test the potential of the substrate to retain archaeological features.
- Underwater archaeological excavation of Log boat Canoe No. 3 to remove it from its current location so that it cannot be impacted on during construction and operation of the landing stage.
- Investigative excavation of Canoe No. 2 is also recommended, to confirm whether it is a tree trunk or not.
- Detailed survey of the new feature recorded in 2021 as an historic landing place. This work would extend along the shoreline to assess more closely the possibility to observe related features.

Given that the geophysical survey completed for the wider project in 2021 has recorded a multivallate enclosure focused on the eastern shore, where the shore appears to have served as the eastern boundary, it is recommended that the lake-bed off the eastern shore is inspected and surveyed archaeologically, to assess whether there are archaeological features exposed in this area. Such work would also inspect the location of the two other log boats recorded in 2011 (Canoe Nos 1 and 4) and would further inform the historical narrative of the development of Holy Island.

Archaeological monitoring by an experienced underwater archaeologist is required of all ground and lake-bed disturbance activities during construction.

A suite of archaeological management recommendations is included.

Recommendations are subject to the approval of the National Monuments Service at the Department of Housing, Local Government and Heritage.

1.0 Introduction

The Archaeological Diving Company Ltd (ADCO) has carried out an Underwater Archaeological Impact Assessment (UAIA) for Archaeological Projects Ltd on behalf of McCullough Mulvin Architects for Clare County Council, to inform the proposed Inis Cealtra (Holy Island) Visitor Experience Project.¹

The archaeological importance of Inis Cealtra on Lough Derg is well known, and the underwater work has focused on the north shore to inform proposals to upgrade the landing area to the island.² One option is to upgrade the existing pier on the northwest shore at ITM 569665E 685342N (Figures 1–2). A second option is to construct a new mooring off the north shore. The assessment extended along the north shore to include both locations.

The survey included a drone survey of the shoreline, a walkover inspection of the landward side, an underwater inspection extending some 50–98 m off shore and a metal-detector survey focused on the shoreline. The site work was completed on 5th May 2021 under archaeological licence from the Department of Housing, Local Government and Heritage, 21D0019, 21R0025.

The report is being completed having had sight of the geophysical survey (draft) and the LiDAR survey commissioned separately for the wider project.³

2.0 Receiving environment

The monastic foundation on Holy Island is associated with a series of early Irish saints.⁴ MacCreiche, described as a holy man, left there when St Colum mac Crenthainn arrived in the sixth century AD. St Colum spent several years at Inis Cealtra before leaving for Terryglass, Co. Tipperary, off the north-eastern shore of Lough Derg. The floruit of the early monastery is associated with St Caimín (died 654) in the seventh century. As with many important monastic centres, Holy Island preserves a range of church buildings, a round tower, and an assortment of supporting features, including bullaun stones and crosses, along with relict field boundaries.

The archaeological excavations conducted by Liam de Paor include the area of the standing ecclesiastical buildings, which date from the tenth century and from the High Medieval period,

¹ Solearth Architecture, 'Inis Cealtra. Visitor management and sustainable tourism development plan'. Report prepared for Clare County Council, Volume 1, 2017.

² Ibid. pp 61–63.

³ Joanne Leigh, 'Geophysical survey, preliminary report. Holy Island (Inishcaltra), Lough Derg, Co. Clare. 21R0095'. J.M. Leigh Surveys Ltd, 2021; LiDAR processing completed by Stephen Davis and made available as a .TIFF image.

⁴ A. Gwynn and R. Hadcock, *Medieval religious houses Ireland* (Dublin 1970, repr. 1988), p. 37.

with earlier elements identified in the ground underneath. The locus of the standing structures on the east and southeast sides of the island, and at its centre, are at a remove from the northern shoreline, while land-based geophysical survey commissioned for the Visitor Experience Project has indicated the presence of a multivallate enclosure enveloping the principal ecclesiastical buildings and perhaps using the eastern shore as a natural perimeter or boundary.⁵

Access to the island is by default over water, and the records of attacks by Vikings in 836 and 922 highlight the importance of the waterways for communication. In doing so, the potential for elements of the island's history to lie submerged at and below the waterline can be considered.

The shoreline has varied over time. The Ordnance Survey (OS) First Edition 6-inch map series from late 1830s shares much in common with the present-day shoreline at first sight (Figure 3). Examination of the OS 25-inch map of c. 1911 suggests that the island's shoreline expanded along its entire eastern side since the mid-1800s, and this would be in keeping with wider drainage activities during the late nineteenth century that resulted in lower water levels (Figure 3b). In contrast, the current ortho-images indicate that the shoreline has retracted since then and is closer to that which existed in the 1830s (Figure 3c). Indeed, the ortho-imagery suggests that the shoreline is somewhat less right around the island, by a matter of some metres (horizontal distance). The variation indicates that the water levels are higher today than they were when the island was recorded by the Ordnance Survey in the 1830s. The variation in water levels is itself slight and may reflect construction of Ardnacrusha Power Station below Lough Derg between 1925 and 1929.⁶ The hydro-electric power station creates a dam effect that may result in slightly elevated water levels on Lough Derg.

There are three constructed landing points on the Inis Cealtra: one in the northwest, which is the current landing area; one at the very northern tip that is now submerged by sedge growth; and one along the east shore beside the Confessional and Caimín's Church. None of these landing points are recorded on historic maps of the island and are twentieth-century constructions.

There has been some underwater archaeological work completed off Inis Cealtra. The discovery of log boats was made by local divers who recorded the vessels under archaeological licence 11D0033, and prepared a useful report in 2011.⁷ The report recorded up to four wooden log boats, which the report refers to as canoes, and one possible additional site. Three of five observations were confirmed as log boats (Canoe Nos 1, 3 and 4), while Canoe No. 2 was not positively identified as a boat and the fifth site was not relocated after it was first observed. The work completed informative surveys of three vessels and provided a GPS location (52.917278 Latitude -8.446583 Longitude Decimal Degrees [ITM 569965E 685253N]) for the sites that were

⁵ Leigh, 'Geophysical survey, preliminary report'.

⁶ See note 4.

⁷ Barry Lemasney and Sinéad Moloney, 'Inis Cealtra dugout canoes report', 2011, report submitted to the National Monuments Service.

located off the northeast shoreline. The more intact vessels were located in an area of soft silt, while the less intact vessels were on a rock surface. All vessels were lying at right angles to the shoreline, and some 40 m into the lake bed. Log boats are commonly found in freshwater environments in Ireland and are a simple type of craft, built as their name implies by carving the interior of a tree trunk into a narrow shallow-drafted vessel. Log boats would have been capable of conveying small groups of people and/or supplies. They enjoy a long period of use in early Ireland, being used during prehistory and well into the medieval period. In many respects they are the pre-cursor of the modern skiff.

3.0 2021 Underwater archaeological survey

3.1 Set-up

The underwater archaeological survey was completed by ADCO over the course of one working day on site, on 5th May 2021, and focused on the shoreline that extends from the existing northwest pier to the area of a possible new mooring off the north shore (Figures 3–4). Full access to the lakebed and project area was possible and no constraints were encountered. The survey included a walkover inspection of the shoreline, a drone survey, a non-disturbance underwater inspection extending some 50–98 m off shore and a metal-detector survey focused on the shoreline area (Plates 1–3).

3.2 Walkover and drone survey

In the geophysical survey completed for the wider project, the north shore area was deemed to be inaccessible, as indeed was the full shoreline of the island.⁸ Trees and undergrowth populate the shore area, and are interspersed among a band of uncompromising rock and small boulder. It is an overgrown low-lying area defined as marsh, where the transition from shoreline to lakebed is at times imperceptible (Plates 4–7).⁹ It is along the northern shoreline that the Register of Monuments and Places records a bullaun stone (CL029-009020). In 2015, the stone was not located due to the overgrown nature of the location.

The rugged shoreline is not, however, the only shoreline of the island. The land area rises distinctly at a remove from the present shoreline, forming a clear scarp that is both broad and high and separates the agricultural land of the island from the marsh, wet grassland and woodland of the foreshore (Plates 8–9). The LiDAR survey that was commissioned for the wider project shows this clearly, where it is possible to trace the scarp around the full circuit of Holy Island (refer to Davis Figure xx).

⁸ Leigh, Geophysical survey, preliminary report', Figure 2.

⁹ See also Solearth, 'Inis Cealtra', p. 37, Figure 9.

The recorded archaeological features are located within the area enclosed by the scarp with the exception of the bullaun stone on the northern shoreline, CL029-009020, and two further bullaun stones to the east that are positioned below the scarp (CL029-009019, CL029-009024). The location of these stones suggests that the scarp feature is from a shoreline that long pre-dates the presence of the monastery on Inis Cealtra.

The current shoreline is not without its own features of interest. The drone survey highlighted one in particular that is worth commenting on (Plate 10, Figure 3).¹⁰ The feature presents itself as a small recess that is located off the north shore at ITM 569931E 685225N. It is a slight feature but it is associated with two lines of stone that extend into the lake bed for several metres. In addition, there is no lake cobble within the enclosed space in contrast to either side of it. The 'clean bottom' would offer safe haven to vessels. The feature is that of a small landing place. Its size and shape are ideally suited for landing small vessels such as log boats. The fact that this location is within the same area as the log boats recorded offshore in 2011 is to be noted. One conclusion to draw is that the current shoreline was an active shoreline during the period of human occupation on Holy Island.

The pier off the northwest shore has seen two stages of construction (Plates 11–12). Both stages represent a utilitarian approach to providing a simple pier. The nearshore component was built by laying rock as a foundation and pouring concrete above, both elements being contained within a shuttering. The jetty was subsequently extended to its current length of 14.5m and it measures 1.47m wide. The extension employed small concrete caissons and covered them in a concrete skim (Plate 13). Three rows were set side-by-side and ran out from the existing pier to create the extension, reaching slightly deeper water at the new terminus. The extension used a series of horseshoes to furnish the pier with low hoops that serve to fix mooring ropes (Plate 14).

The pier is one part of this landing area. The other part lies to its immediate south and is a small docking area constructed using concrete and measuring 6.65m long by 3.3m wide (Figure 4 Plate 15). The docking feature served the Holy Island ferry that is lying on the western shore of the lake at Knockaphort Pier. The ferry is currently in a derelict state but would have facilitated the transfer of livestock to and from the island.

Inshore of the dock is a small building that would have served to greet visitors. The building is derelict.

3.3 Underwater inspection

The underwater inspection commenced at the northwest pier and proceeded around the north shore to its eastern limit. The inspection extended 50 m off shore at the northwest pier and up

¹⁰ When reviewing the drone images, Jimmy Lenehan was first to see this feature, and we are grateful to his eagle-eyed detection.

to 98 m offshore along the north shore, covering a distance of 365 m West-to-East (Figures 4–5). A team of four divers progressed around the island, spread out in a line that extended out from the shoreline. The deployment ensured 100% coverage of the area. Water visibility was very good at 3–5m, ensuring ample opportunity to observe detail close-up as well as from afar.

Topography

The lake bed for the most part shelves gently from the shoreline making water depths very shallow inshore. The area around the northwest landing is a stony bottom (Plate 16). The stony bed gives way to a soft silt/mud that is often more than a metre deep (Plate 17). The silt/mud bottom reaches northwards to the northern point to the island, at which point expanses of reed and sedge vegetation occur and are intermixed with rock/boulders to present pockets of a hard bottom (Plate 18). The north shore of the island cuts back to the southeast. At first the reeds / sedge and rocky bottom continue and is quite impenetrable apart from a narrow channel to the north that lies just to the south of the islet, Illaunaskirtaun. This mass is indicated on the historic OS maps and appears to represent a natural extension of harder ground northwards (Figure 3). The shallows give way to the east and the lake bed returns to being a soft silt/mud surface. It is in this area that the log boat Canoe No. 3 is located. Close inshore, the deep silt gives way to rock, which reaches close to the surface and south of which the water levels are very shallow (Plate 19). The line of rock was recorded and it follows the orientation of the current shoreline to the south (Figures 4–5). The shoreline itself drops quickly to the lakebed, some 200mm below.

Northwest Pier

The base of the concrete pier is buried in the covering shingle (Plate 20). To the west of the pier terminus is a mass of tyres, which are presumably abandoned fenders employed on the ferry (Plate 21).

Northwest, post. ITM 569713.80E 685397.66N

A single timber post was recorded on the lake bed north of the pier (Plate 22). The post rises 300mm above the surface of the lake bed and has a diameter of 150mm. The post stands at a slight angle. It appears to be a soft wood and it stands in isolation. The purpose of the post is not clear.

Log boat Canoe No. 3. West end ITM 569966.61E 685253.53N, East end 569972.70E 685253.28N

The 2011 report recorded the Canoe No. 3 as being: ‘embedded in silt. [In] excellent condition. [Measuring] 6.6m in length and tapers from 0.8m to 0.7m in width. Square in cross-section. External depth 0.5m, internal depth 0.4m. Sides are 0.036m thick. A rectangular patch 12cm x 16cm held in place by iron nails. A third nail is lying loose. The nail shanks are square in cross-

section with a pyramid shaped head. The interior of this boat shows tool marks'.¹¹ The report included a plan and photographs (Plates 23–24).

The location coordinate provided in the 2011 report refers to that of Canoe No. 3, which is positioned immediately to its southeast. The guide-lines used to record it in 2011 remain in place (Plate 25). The vessel is largely buried in the silt but its outline is still visible (Plates 26–29). The 2021 survey confirmed its East-West orientation.

Metal-detection of the lake bed around the log boat located two iron nails and one copper nail lying loose in the silt within 500 mm of the bow of the craft (Plate 30–32). The nails were recovered as they were deemed to be at risk of being lost. The iron nails are hand-forged with flat rectangular heads, measuring 20 mm long by 14 mm wide and 2 mm thick. The shank on one nail is 62 mm long and round in section, while the shank on the other nail is 28 mm long and squared in section. Both nails are oxidised and in poor condition, indicating they have been lying exposed on the lake bed for some time and were not buried in the substrate. Neither nail has a pyramidal-shaped head as was described of the nails recorded in 2011. The copper nail has a simple circular flat head that measures 10 mm in diameter. The underside of the nail head tapers to the shank that is squared in section and measures 75 mm long. The tip of the shank is broken off and the shank retains a slight bend along its length, with scoring on one of the edges. In overall length the nail measures 78 mm. The 2011 report records a wooden patch applied to the bow section of the log boat that was held in place by two nails, with a third nail lying loose. The 2021 inspection did not disturb the sediment that has accumulated within the vessel and so did not expose the patch. Given the proximity of the three nails to the log boat it is probable that they are associated with the vessel.

Loose timber. ITM 569955.45E 685251.22N

A loose timber was observed lying on the lake bed between Canoe No. 3 and the shore (Figure 5, Plates 33–34). It may be described as a post or a plank and was lying flat on the bed.

Tree trunk, Canoe No. 2. ITM 569997.06E 685228.21N

The location of Canoe No. 2 was observed to the southeast of log boat Canoe No. 3. In 2011 Canoe No. 2 was described as, 'partially buried in silt. Not positively identified as a boat'.¹²

A substantial length of the feature was observed in the correct location, comprising the surface of a tree trunk, the body of which lies buried in the ambient silts (Plate 35). The grain of the timber is clearly visible, and it appears to be a soft wood. There are no indications from the exposed element of toolmarks or worked features indicative of having been adapted for use. The 2021 observation is that the item is probably not a log boat and is more likely to be a tree

¹¹ Lemasney and Moloney, 'Inis Cealtra', p. 1.

¹² Idem.

trunk. However given that much of the feature is buried, the possibility that this is a log boat that has been inverted cannot be ruled out.

Canoe Nos 1, 4

Canoe Nos 1 and 4 are located further east and lay outside the 2021 survey area. Consequently, they were not inspected.

Invasive species

It is appropriate to include a comment on invasive species. In the 1980s, underwater inspection of the freshwater lakes in Ireland would encounter no such species, and much of the archaeological features lay exposed on the lake beds. However, the presence of zebra mussels and Japanese pond weeds in more recent times is progressively altering the narrative. As indicated on Plates 22 and 34 the presence of zebra mussels in Lough Derg and at Inis Cealtra is concealing archaeological features from view. There has yet to be any coherent study of the impact of invasive species on archaeological receptors underwater, so it is unclear whether they are effecting physical damage as well as concealment. The level of zebra mussels present varies across the extent of the area inspected; they appear to be present in greater numbers off the northwestern shore than off the north shore, but it may be useful in the longer term to set up a monitoring regime that would look particularly at Inis Cealtra as an exemplar for this issue in the archaeology of Irish freshwater lakes.

ADCO's biosecurity protocols absorb those of Waterways Ireland, which ensures that all equipment and vehicles in touch with the water during site operations are cleaned down and disinfected before leaving site.

3.4 Metal-detector survey

A metal-detector survey was undertaken along the northern shoreline using a Garrett AT Max metal-detector and extending 2–3 m into the lake from the shore. Targets were quite sparse, with small ferrous hits (which were not retrieved) at a concentration of 1 per every 2m². Non-ferrous hits were noted at a rate of approximately 1 in every 4m². The non-ferrous targets were predominantly lying on the lake bed on the surface the gravels. Most were discarded shotgun shell-ends (Plate 36). Only two coins were retrieved, and both were modern; 1975 Irish two-pence and 1978 Irish five-pence. Two lead fishing weights and a spinner were also retrieved. A small copper nail, square in section, was recovered, along with a substantial number of modern bottle tops that were located in isolated pockets as a result of wash-in. This material was photographed but not retained.

The area around the northwest pier was also considered. Three small broken pieces of a riveted lead bar with alloy sheathing were recovered (Plate 37). The pieces all came from a 200 mm diameter area and the find place was recorded (Figures 4–5). The alloy sheathing is a bright

yellow colour, and images were sent to the National Museum of Ireland for consideration. The Museum is open to submitting the pieces to an xrf-analysis to determine metal type and in the meantime suggests that the bright metal is perhaps a copper sulphate corrosion product formed from anaerobic conditions.¹³ If correct, the piece is probably leaden lining that would have sealed a window or other boat fitting and is not of historic interest.

4.0 Discussion

Underwater archaeology remains a young discipline in Ireland, and since the Crannog Archaeology Project conducted in 1980s as a joint research exercise by the National Museum of Ireland and Cornell University, the basis for appreciating the potential of the discipline has been created and developed. Quite aside from the many thousands of shipwrecks that populate the offshore marine environment, research continues to demonstrate the largely untapped resource that exists in our rivers and lakes. While the initial observations were concerned to demonstrate the potential of early medieval and medieval-period crannog sites, investigations within the River Shannon at the monastic centre of Clonamcnoise in the 1990s helped to broaden the narrative. The discovery of a ninth-century timber bridge at Clonamcnoise caught wider attention but the work also recorded a series of log boats on the riverbed, lined-up almost in a row on the riverbed beside the riverbank that opens directly onto the monastery. A comparison with the log boat discoveries at Inis Cealtra in 2011 is easy to draw. Most recently the work of the Underwater Archaeology Unit in conjunction with local interests on Lough Corrib has created a particular research environment that is focussed on the log boats of Lough Corrib and their wider lacustrine context.

In contrast to the extensive land-based excavations conducted on Inis Cealtra under the direction of Liam de Paor, there have been only two brief archaeological assessments under water, one in 2011 and the other now in 2021. On both occasions, archaeological remains have been recorded, and these findings speak to the high archaeological potential of the underwater environment at Holy Island. The report of 2011 records the presence of log boats off the north-eastern shore of the island. Over the course of one day on site, the 2021 inspection has added additional insight. In considering the nature of the pier off the northwest shore, the work highlights a piece of 'Contemporary Archaeology', which is perhaps of local interest only but presents the opportunity to record ordinary undocumented building work of the twentieth century. The work has also recorded a timber post standing in isolation to the north of the pier, which begs the question of its purpose.

¹³ Email correspondence NMI to ADCO, 07/05/2021.

The 2021 survey confirmed the identification of Canoe No. 3 as a log boat. The presence of iron nails indicates that this log boat most likely belongs to the historic period rather than to prehistory and this in turn raises the possibility that the log boat was contemporary with the monastic centre. In discovering the three metal nails on the lake silts off its bow, the work also expands the archaeological narrative to questions around the stable condition of the log boat in its current location.

If Canoe No. 2 is more accurately described as tree trunk, one wonders whether excavation to expose the buried element of the timber might be able to confirm this interpretation.

While the locations of Canoes 1 and 4 lay outside the 2021 survey area, importantly, the drone survey has identified an historic landing place on the shoreline. The landing place is small and presents itself as more of a cut-out than anything else, but it is a type of feature that occurs along other river systems, where the space provides for the docking of a single vessel safely. The feature shows the active use of the northern shoreline of Holy Island for landing vessels.

The 2011 report refers to the other log boats recorded further east as being on rocky substrate, while Canoe No. 3 lies in soft silt. The area to the west of Canoe No. 3 is also one of soft silt where one can expect the holding content to be very good for the preservation of objects that might be buried in it. If indeed the north shore served as a landing area in the medieval period, the current proposal to consider this as a new landing area in the twenty-first century suggests restoring the logical mooring place for the island. Should this option proceed, further underwater archaeological inputs are recommended to both inform the archaeological narrative and to safeguard the elements that are known already.

5.0 Impact assessment

The proposed impacts are associated with either upgrading the northwest pier or constructing a new landing off the northern shoreline.

It is likely that to upgrade the northwest pier it will be necessary to largely remove and/or bury the existing structure as the upgrade will require raising the deck level, constructing a breakwater feature to protect against foul weather, and constructing new paths for access.¹⁴ It is also anticipated that the upgrade would include extending the existing pier footprint in length into the lake bed, and possibly also in width, and would incur impacts into the lake sediments associated with piling and/or related construction activities.

¹⁴ Solearth, 'Inis Cealtra', p. 63.

The location proposed for the construction of a new landing off the north shore lies west of the recorded log boat (Canoe No. 3) and of the landing place feature identified in 2021 (compare Figures 3 and 4). The proposed new landing, while technically away from these two exposed archaeological features is nevertheless very close to them and some level of indirect impacts can be anticipated either during construction or when operational, or both. The archaeological potential of the area is high as witnessed by both features. The archaeological potential is also qualified by the underlying soft mud substrate in this area, which presents an ideal holding content for archaeological features that might remain buried in the lake bed. The design detail of the proposal is anticipated to include piling that will have a direct impact on the lake sediments.

6.0 Recommendations

The proposal to upgrade the existing northwest landing is likely to encounter less archaeological risk than to construct a new landing off the north shore. For this reason, it is recommended that consideration be given to upgrading the existing pier. Given the archaeological potential of the island, further underwater archaeological input is recommended in advance of construction regardless of which design option is selected. All archaeological work under water is subject to archaeological licensing by the Department of Housing, Local Government and Heritage.

6.1 Pre-construction recommendations

Advance underwater archaeological work would include:

Northwest pier option

- Additional survey of the existing pier and land area, to present a permanent record of the pier before it is transformed.
- Underwater excavation at the proposed construction impact locations (e.g. pile locations), using hand-operated suction dredges to test the potential of the substrate to retain archaeological features.

North shore landing option

- Detailed underwater survey of the construction footprint. Such work would seek to undertake detailed topographic survey of the lake bed and the lake shore area within the development footprint to present a permanent record of the topography prior to construction. Such work would also assess more closely the potential for archaeological remains.

- Underwater archaeological excavation using hand-operated suction dredges to test the potential of the substrate to retain archaeological features. Such work would focus on the position of construction impacts (e.g. pile locations, anchor locations).
- Underwater archaeological excavation of Log boat Canoe No. 3 to remove it from its current location so that it cannot be impacted on during construction and operation of the landing stage. Removal of the log boat would be subject to the requirements of the National Museum of Ireland and the National Monuments Service.
- Investigative excavation of Canoe No. 2, to confirm whether it is a tree trunk or not.
- Detailed survey of the landing place identified on the shoreline in 2021. The detailed survey should extend along the shoreline to assess more closely the possibility to observe related features.

Northeast and eastern shoreline

Given that the geophysical survey completed for the wider project in 2021 has recorded a multivallate enclosure focused on the eastern shore, where the shore appears to have served as the eastern boundary, it is recommended that the lake-bed off the eastern shore is inspected and surveyed archaeologically, to assess whether there are archaeological features exposed in this area. Such work would also inspect the location of the two other log boats recorded in 2011, namely Canoe Nos 1 and 4, and would further inform the historical narrative of the development of Holy Island.

6.2 Construction phase recommendations

Archaeological monitoring by an experienced underwater archaeologist of all land and lake-bed disturbance works is required during the construction phase.

6.3 Archaeological management recommendations

RETAINING AN ARCHAEOLOGIST/S. An archaeologist specialised and experienced in underwater archaeology will be retained by Clare County Council for the duration of the relevant works.

ARCHAEOLOGICAL LICENCES will be required to conduct the on-site archaeological works. Licence applications require the inclusion of detailed method statements, which outline the rationale for the works and the means by which the works will be resolved. One can anticipate that the following licence types will be required: Excavation, to cover investigation and monitoring works; Detection, to cover the use of metal-detectors; and Dive Survey, to cover the need for underwater inspections and investigations/excavations. Licence applications take a **MINIMUM OF FOUR WEEKS** to process through the Department, and advance planning is required to ensure that the necessary permits are in place before site works commence. Given that Holy Island is a National Monument, Ministerial Consent is required, and an eight-week application period may be anticipated for same.

ARCHAEOLOGICAL MONITORING will be carried out by suitably qualified and experienced underwater archaeological personnel licensed by the Department of Housing, Local Government and Heritage. Archaeological monitoring is conducted during all terrestrial, foreshore and lake bed disturbances associated with the development.

The monitoring will be undertaken in a safe working environment that will facilitate archaeological observation and the retrieval of objects that may be observed and that require consideration during the course of the works.

The monitoring will include a finds retrieval strategy that is in compliance with the requirements of the National Museum of Ireland.

THE TIME SCALE for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeologically significant features or material being uncovered during the construction phase, machine work will cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material will be recommended. If it is not possible for the construction works to avoid the material, full excavation will be recommended. The extent and duration of excavation will be a matter for discussion between the client and the licensing authorities.

ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.

ARCHAEOLOGICAL DIVE TEAM. It is recommended that an archaeological dive team is retained on standby for the duration of any in-water disturbance works on the basis of a twenty-four or forty-eight hour call-out response schedule, to deal with any archaeologically significant/potential material that is identified in the course of the seabed disturbance activities.

A SITE OFFICE and facilities will be provided by the Clare County Council on site for use by archaeologists.

SECURE WET STORAGE facilities will be provided on site by Clare County Council to facilitate the temporary storage of artefacts that may be recorded during the course of the site work.

BOUYING/FENCING of any such areas of discovery will be necessary if discovered and during excavation.

MACHINERY TRAFFIC during construction will be restricted to avoid any identified archaeological site/s and their environs.

SPOIL will not be dumped on any of the selected sites or their environs.

POST-CONSTRUCTION PROJECT REPORT AND ARCHIVE. It is a condition of archaeological licensing that a detailed project report is lodged with the DHLGH within 12 months of completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland

Recommendations are subject to the approval of the National Monuments Service at the Department of Housing, Local Government and Heritage.

7.0 Acknowledgements

Thanks are extended to Joan Tarmey of Clare County Council, Thomas Mackey of Tobins, Naoimh O'Neill and Joe Stokes of McCullough Mulvin and Claire Walsh of Archaeological Projects Ltd for facilitating access. Thanks also to Steve Davis, UCD, for preparing a geo-referenced TIFF of the LiDAR data and Nessa O'Connor and Paul Mullarkey of the National Museum of Ireland for correspondence relating to the small finds. The archaeological team on site comprised Niall Brady, Rex Bangerter, Derek Copeland, Dan Lenehan, Jimmy Lenehan, Brian MacAllister and Feargal Morrissey. The drone survey was completed by Dan Lenehan, and the metal-detection by Dan and Jimmy Lenehan. The report figures were prepared by Rex Bangerter and Derek Copeland and the report by Niall Brady.



Plate 1: Drone survey being deployed.



Plate 2: Members of dive team kitted up on the Northwest Pier preparing to commence underwater inspection.



Plate 3: The Lenehan brothers in the process of metal-detection.



Plate 4: View looking west from Holy Island across the wetland that forms the shore area.



Plate 5: View from lake area looking south onto the north shore area of Holy Island.



Plate 6: Drone image looking northwest across the north shoreline and highlighting the nature of the marshy environment. The islet Illaunaskirtaun in the middle distance.



Plate 7: Drone image looking west across the north shore area of Holy Island, showing the topography rising behind the marsh shoreline.



Plate 8: View looking south from the north shore, showing the rising ground to a scarp feature.



Plate 9: Drone image looking southwest across the north shore of Holy Island, showing the topography rising along a defined scarp that is populated with low vegetation.

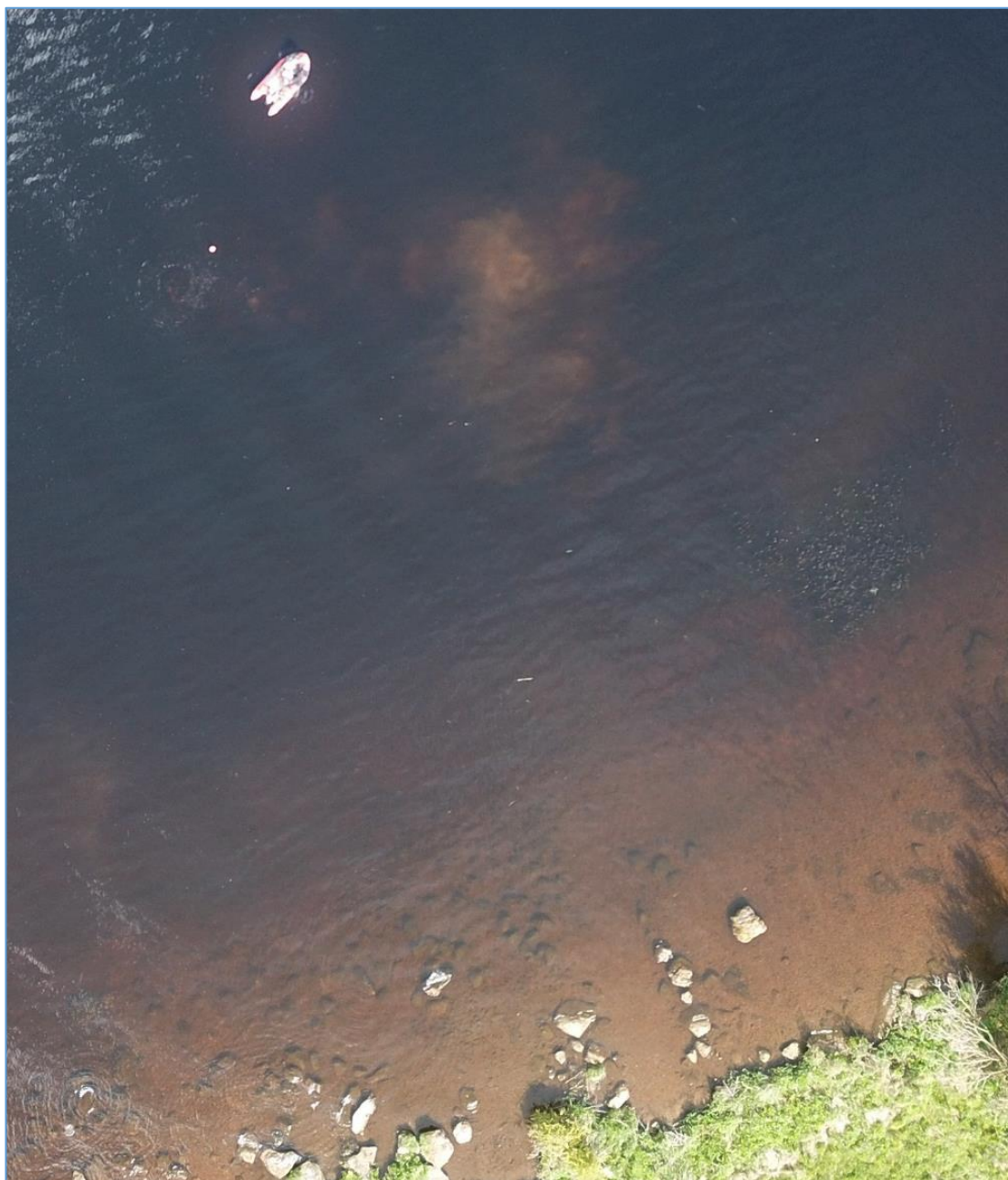


Plate 10: Drone image looking directly down on north shore. The two parallel lines of stone in the lower centre-right of picture highlight the presence of the historic landing area discovered in 2021. The image also shows the lakebed within the small enclosed space is free of stone and cobble, which is a further indication of its constructed nature, offering a safe haven.



Plate 11: View looking at the northwest pier from the south. The earlier construction phase is clearly distinct from the later component added to the lake side.



Plate 12: View looking east along length of the northwest pier. The ferry dock is to the right.



Plate 13: View looking at the join between the older part (top) of the northwest pier and the later addition (centre and bottom).



Plate 14: Detail showing horseshoe re-used as pier furniture for tying-off vessels.



Plate 15: View looking southwest across pier at the ferry dock that would be used to transport livestock off the island.



Plate 16: Underwater photograph showing the nature of the stone bed next to the northwest pier area.



Plate 17: Underwater photograph showing the nature of the silt/mud surface that is observed over much of the north shore area.

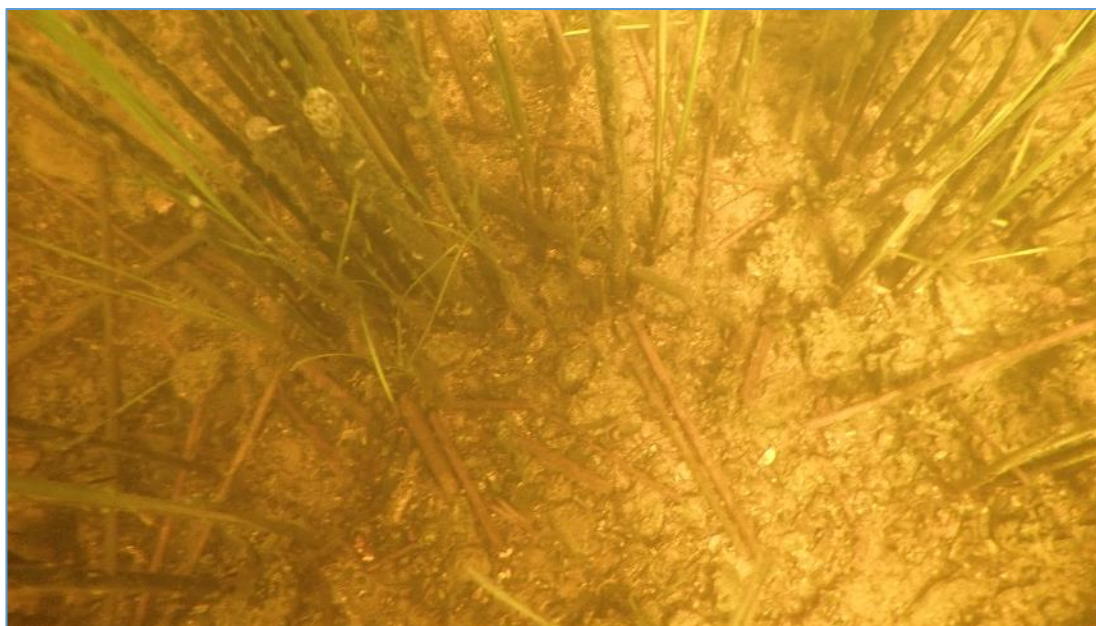


Plate 18: Underwater view of the lakebed in the vicinity of the reed growth, showing a compact stony surface.

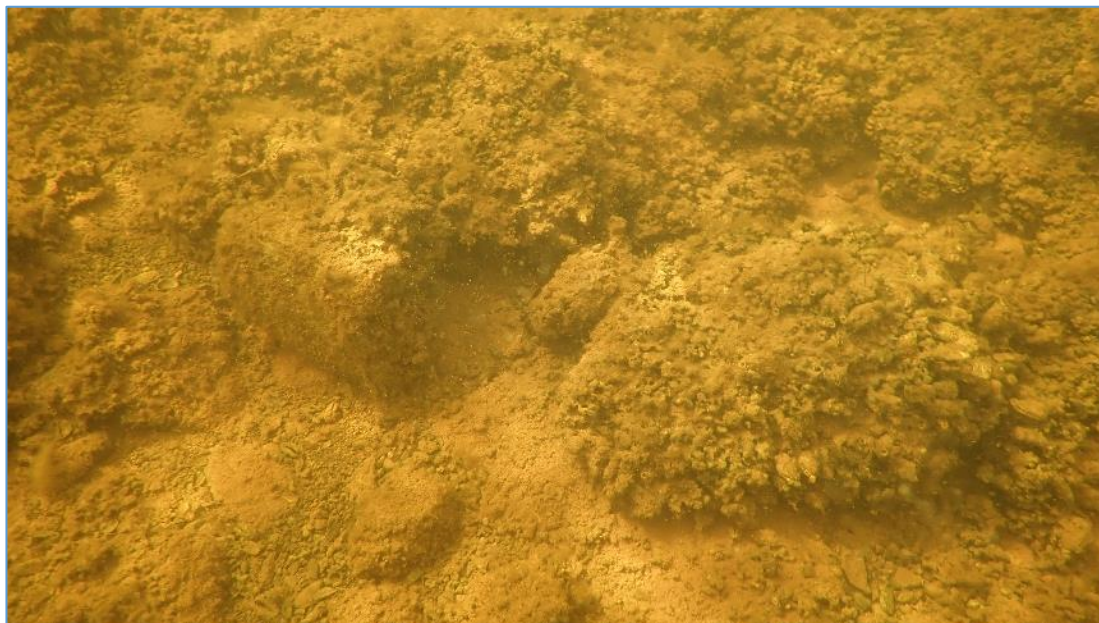


Plate 19: Underwater view of the line of rock that exists off the north shore.



Plate 20: Underwater view showing interface between the base of the northwest pier and the lakebed.

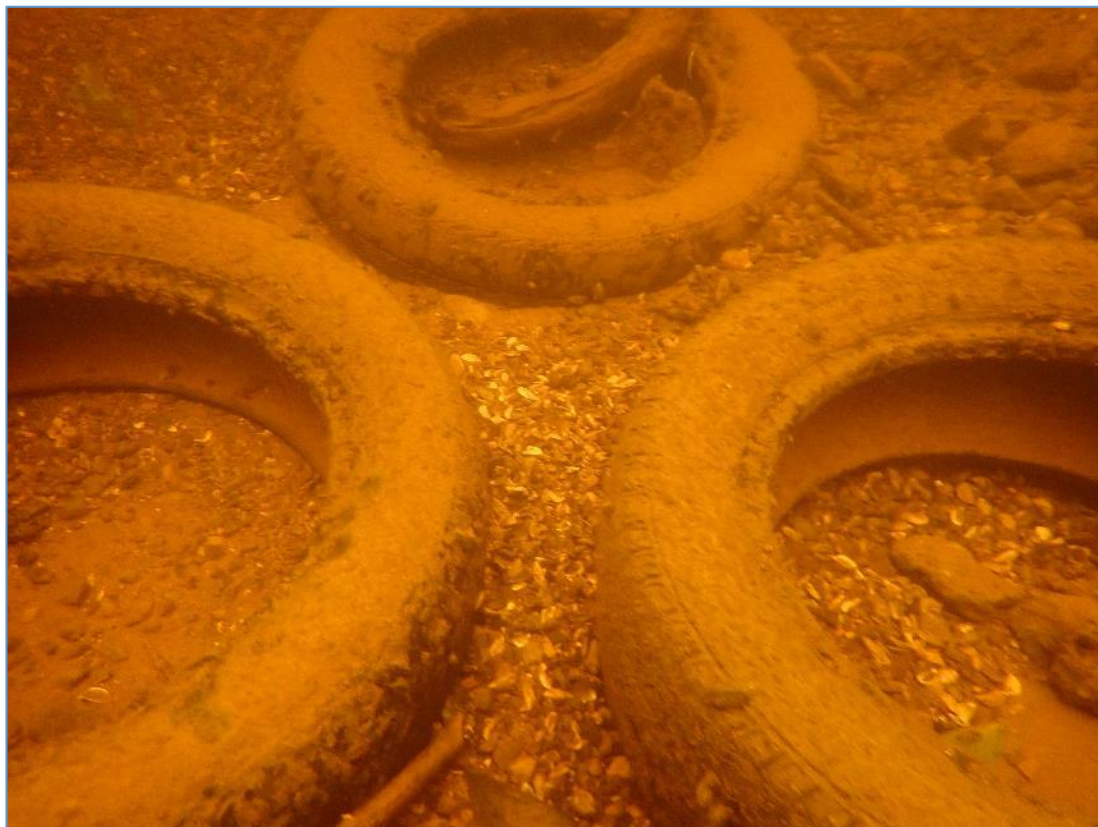


Plate 21: Underwater view showing part of the collection of discarded tyres off the northwest pier.



Plate 22: Underwater view showing the timber post that stands proud of the lakebed off the northwest shore. Note the density of zebra mussels that cover the post all but obscuring it from view.

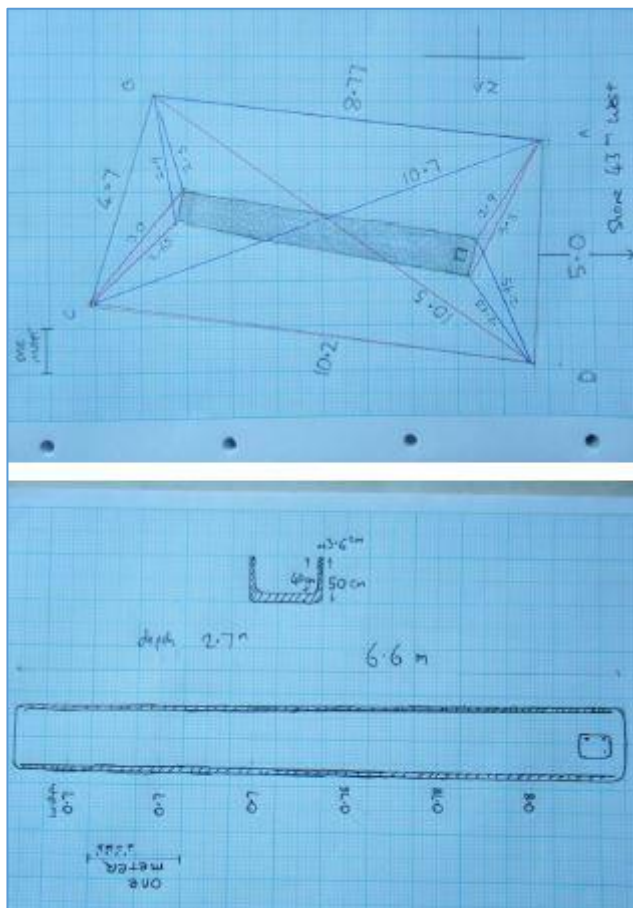


Plate 23: Survey record of log boat Canoe No. 3 as recorded in the 2011 report.

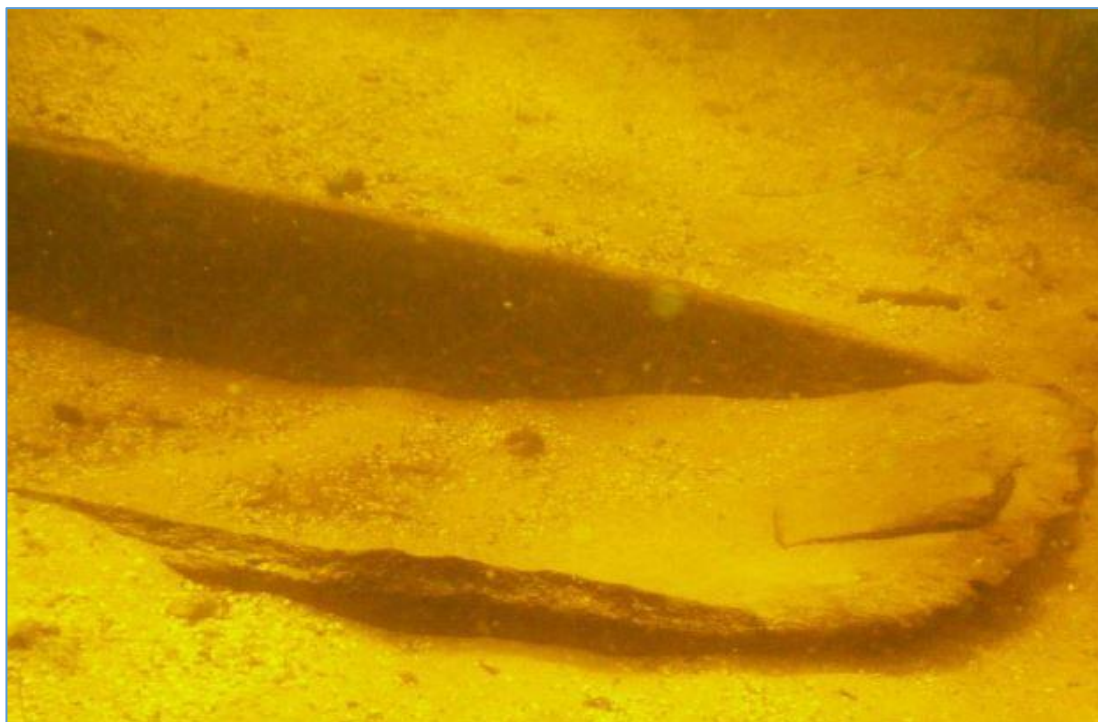


Plate 24: Underwater view of log boat Canoe No. 3 as presented in the 2011 report.



Plate 25: Underwater view in 2021 of guide ropes and corner tie point left in place from 2011 survey.

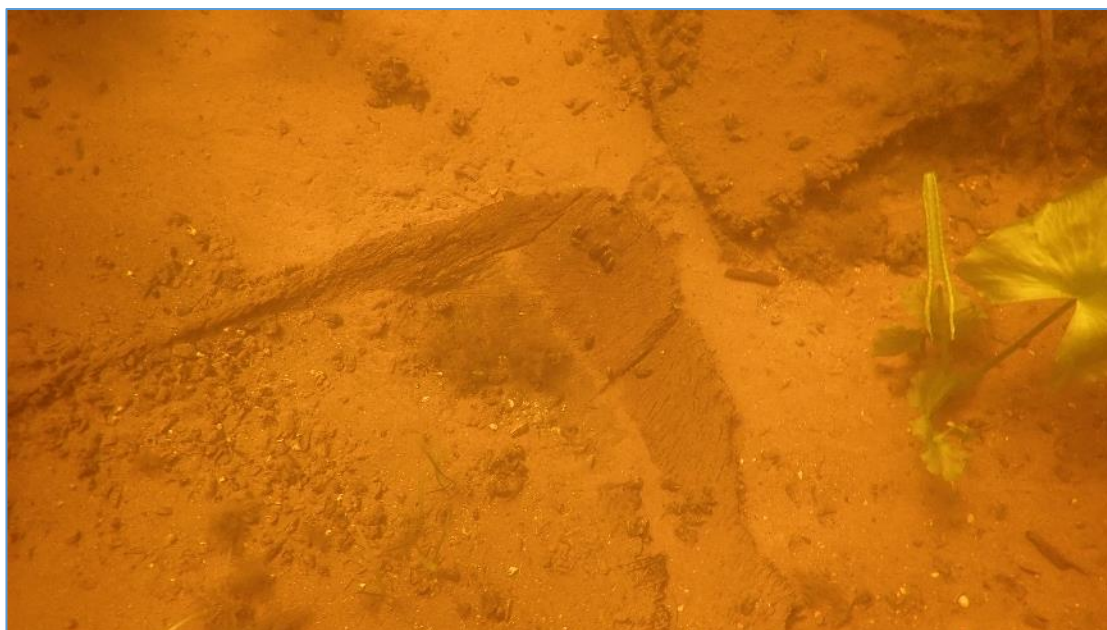


Plate 26: Underwater view of log boat Canoe No. 3 in 2021 showing exposed bow.



Plate 27: Underwater view of log boat Canoe No. 3 in 2021 showing exposed sides and infilled central area.



Plate 28: Underwater view of log boat Canoe No. 3 in 2021 looking down on to exposed bow.



Plate 29: Underwater view of log boat Canoe No. 3 in 2021 looking down on to exposed bow, with scale.



Plate 30: Underwater view in 2021, showing metal-detector survey around exterior area of log boat Canoe No. 3.



Plate 31: Iron nails x2 and copper nail x1 recovered from lake bed off the bow of log boat Canoe No. 3.



Plate 32: Iron nails x2 and copper nail x1 recovered from lake bed off the bow of log boat Canoe No. 3.



Plate 33: Underwater view showing timber post or plank lying loose on the lake bed.



Plate 34: Underwater view showing end-shot of timber post/plank. The section is distorted by a mass of zebra mussel on the bottom of the picture.

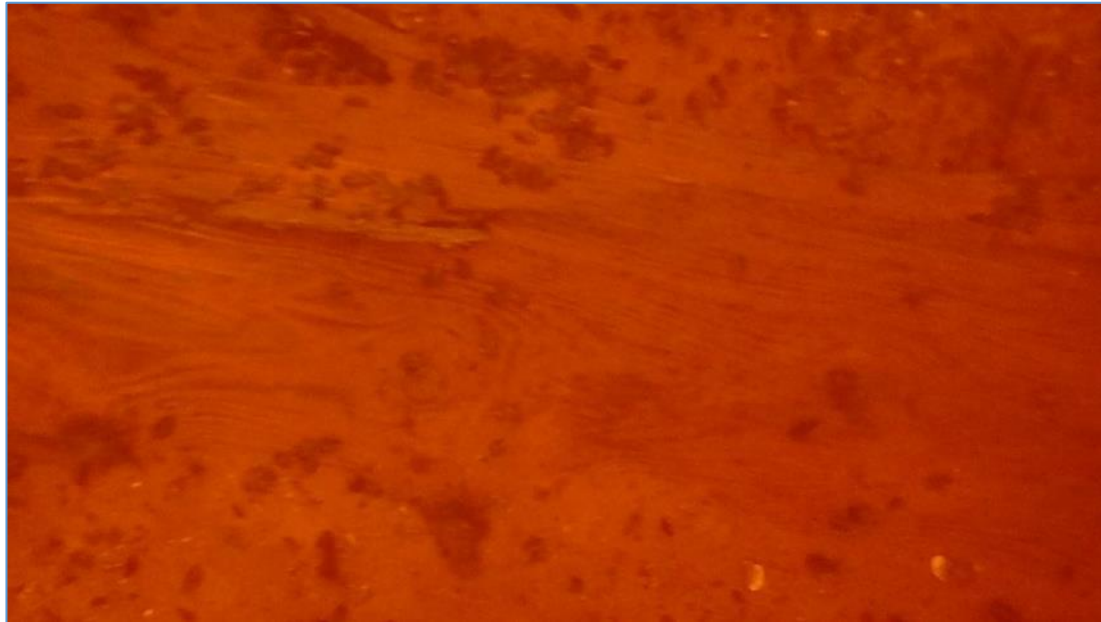


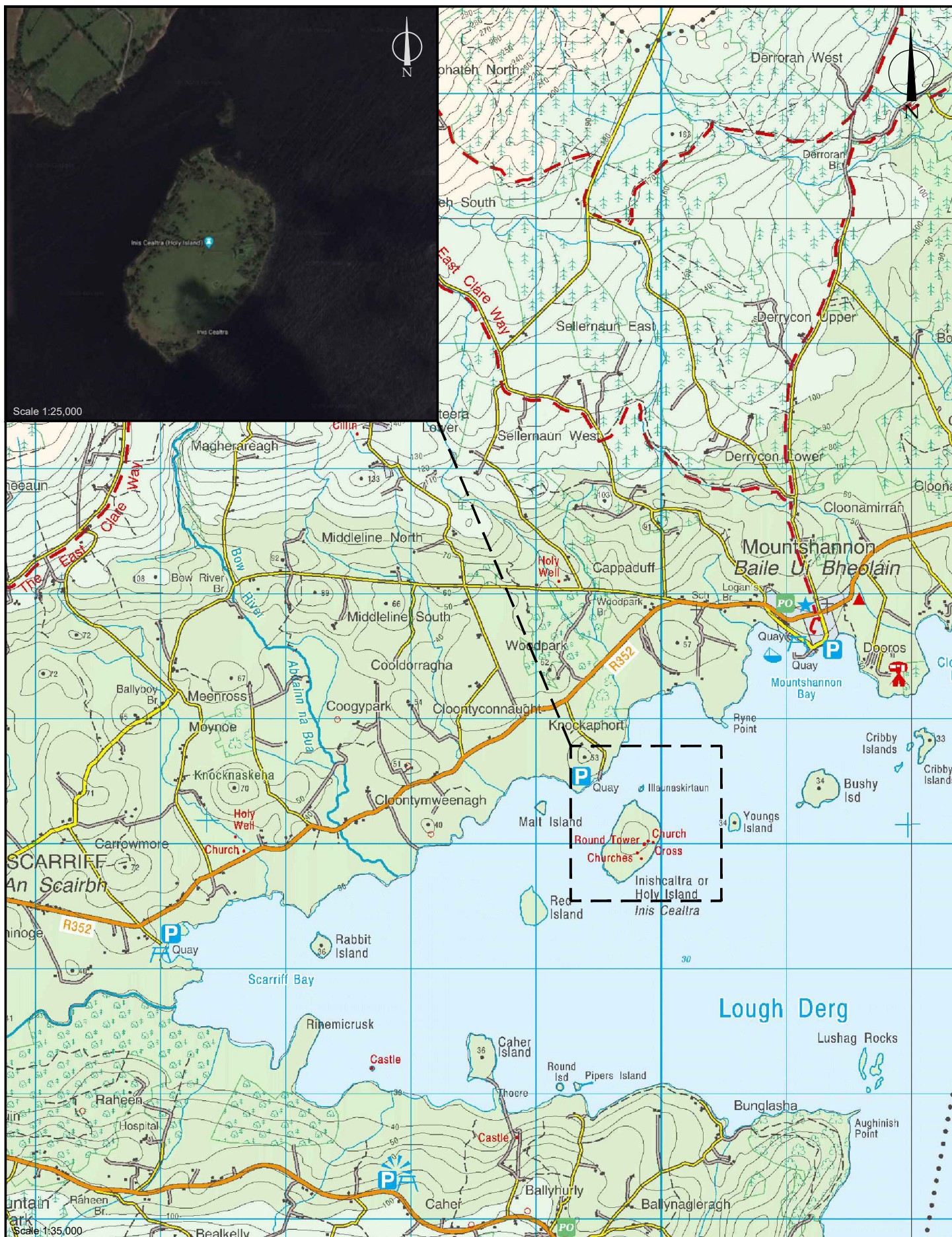
Plate 35: Screen grab from underwater video at location of Canoe No. 2 in 2021 showing the grain of the timber running across the picture. One the very upoer surface of this features is exposed.




Plate 36: Selection of objects recovered from metal detection along the north shore. None are retained.




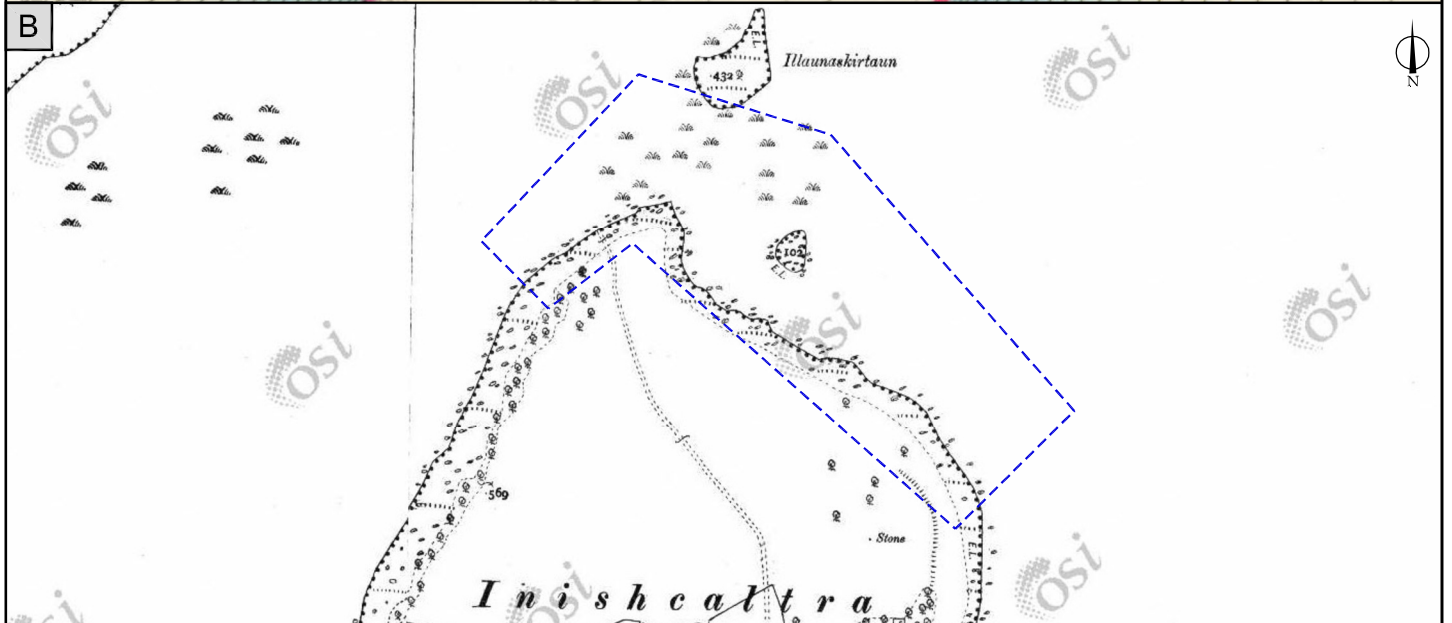
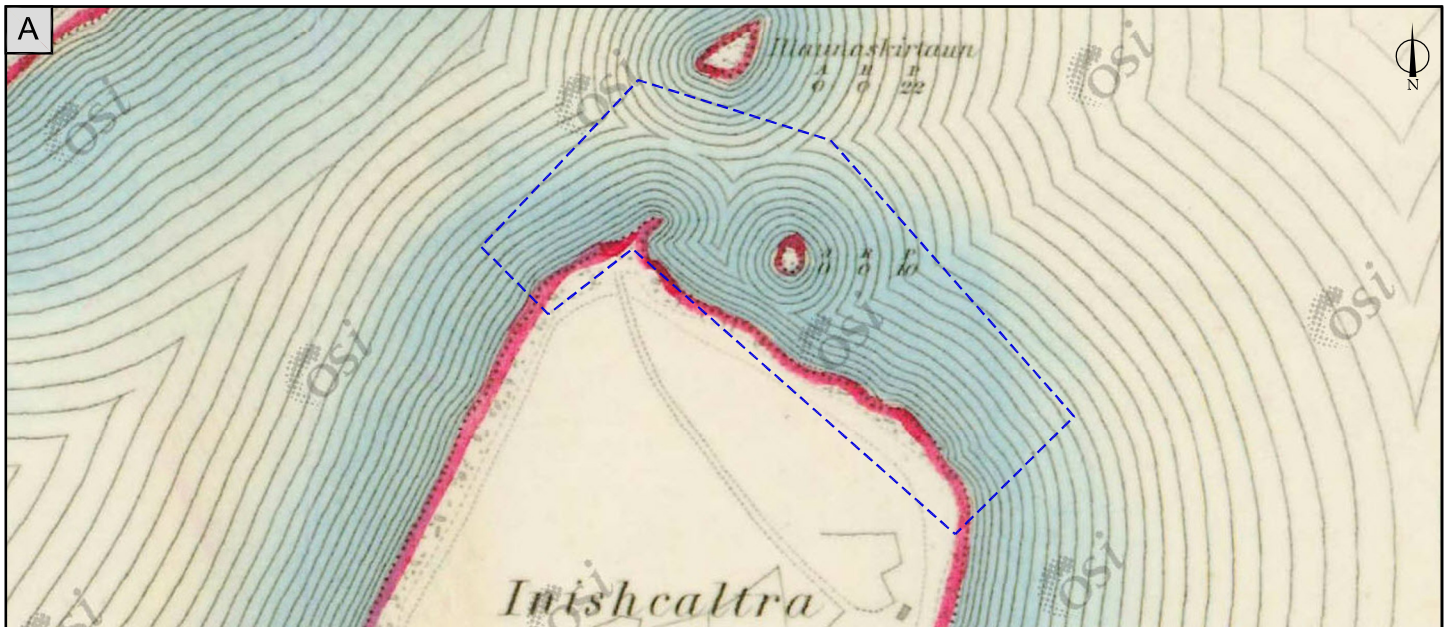
Plate 37: Three pieces of leaded object with allow sheathing, recovered beside the northwest pier.



		<div>Notes</div> <div>Source: Main OSi Discovery Series (1:50,000) Mapping. Inset Google Satellite Imagery.</div>			<div>A4</div>		<div>Title</div> <div>Figure 1: Main- OS Discovery Series Map showing location of Inis Celatra, Lough Derg, County Clare. Inset- Satellite Imagery of the island.</div>	
<div>Client</div> <div>Archaeological Projects Ltd. for McCullough Mulvin for Clare County Council</div>								
<div>Project</div> <div>Inis Cealtra (Holy Island), Visitor Experience Project</div>		<div>Job/Exc No.</div> <div>21D0019</div>	<div>Compiled by</div> <div>R.Bangerter</div>	<div>CAD reference</div> <div>Inis_Cealtra</div>	<div>Date</div> <div>16.06.21</div>	<div>Scale</div> <div>1:35,000/ 1:25,000</div>	<div>Drawing No.</div> <div>Figure 1</div>	



		Notes Source: A- Project Drawing supplied by client. B- Google Satellite Imagery.			<div>A4</div>	Title Figure 2- Proposed development boundaries [Options 1-2] and associated ADCO Survey Areas superimposed upon satellite imagery of Inis Cealtra.		
Client Archaeological Projects Ltd. for McCullough Mulvin for Clare County Council								
Project Inis Cealtra (Holy Island), Visitor Experience Project		Job/Exc No. 21D0019	Compiled by R.Bangerter	CAD reference Inis_Cealtra	Date 16.06.21	Scale 1:2000/ 1:5000	Drawing No. Figure 2	



ADCO

Notes

----- Extent of ADCO Survey Area

Source: OS Historic Map Archive accessed via the NMS
Historic Environment Viewer.

A4

Title
Figure 3- ADCO Survey Area superimposed upon
the following:

- AJ. OS First Edition (1842) Map.
- BJ. OS 25-inch Edition (1888-1913) Map.
- CJ. Digital Globe Orthophotography (2010)

Client
Archaeological Projects Ltd. for McCullough Mulvin for Clare County Council

Project
Inis Cealtra (Holy Island), Visitor Experience Project

Job/Exc No.
21D0019

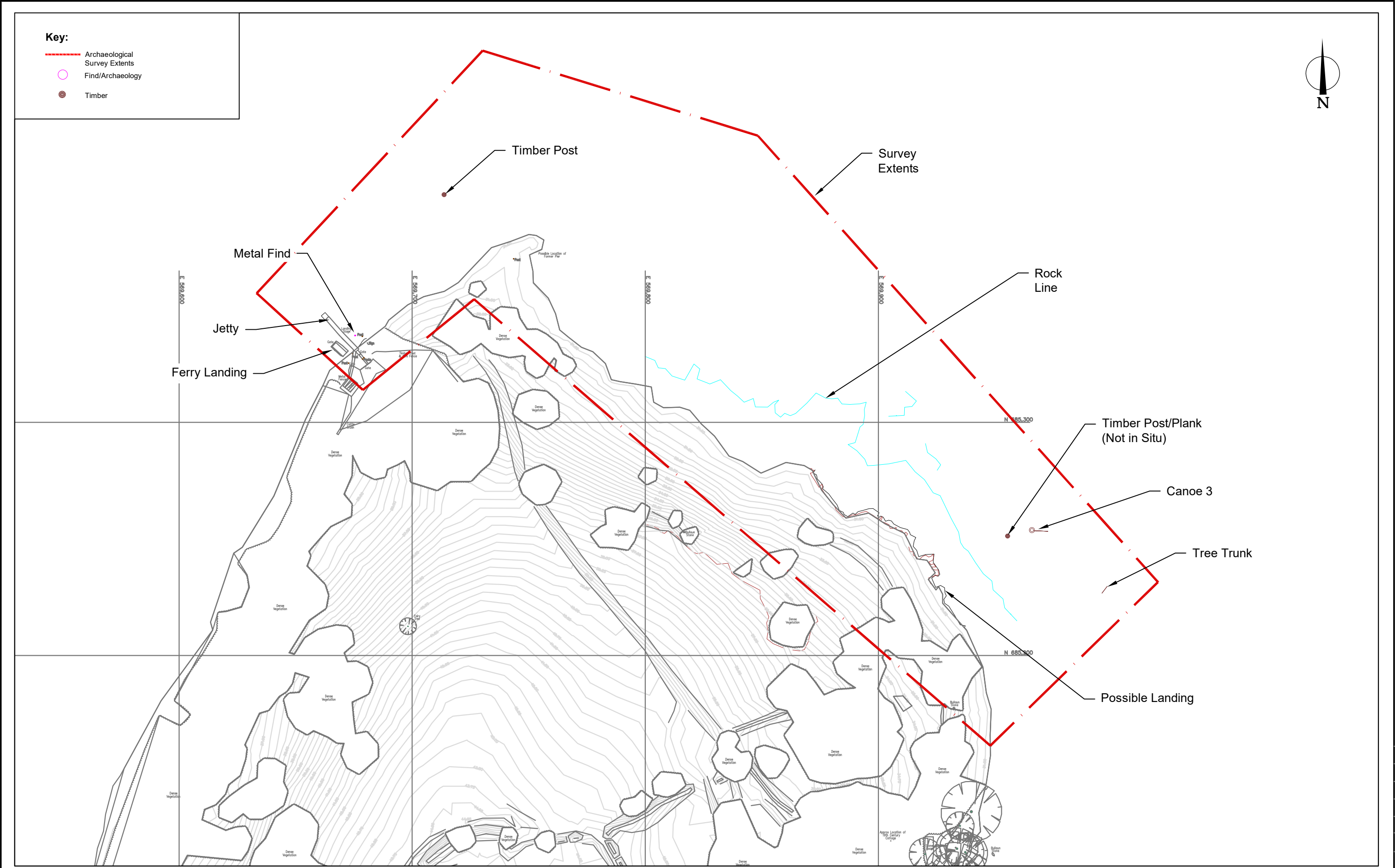
Compiled by
R.Bangerter

CAD reference
Inis_Cealtra

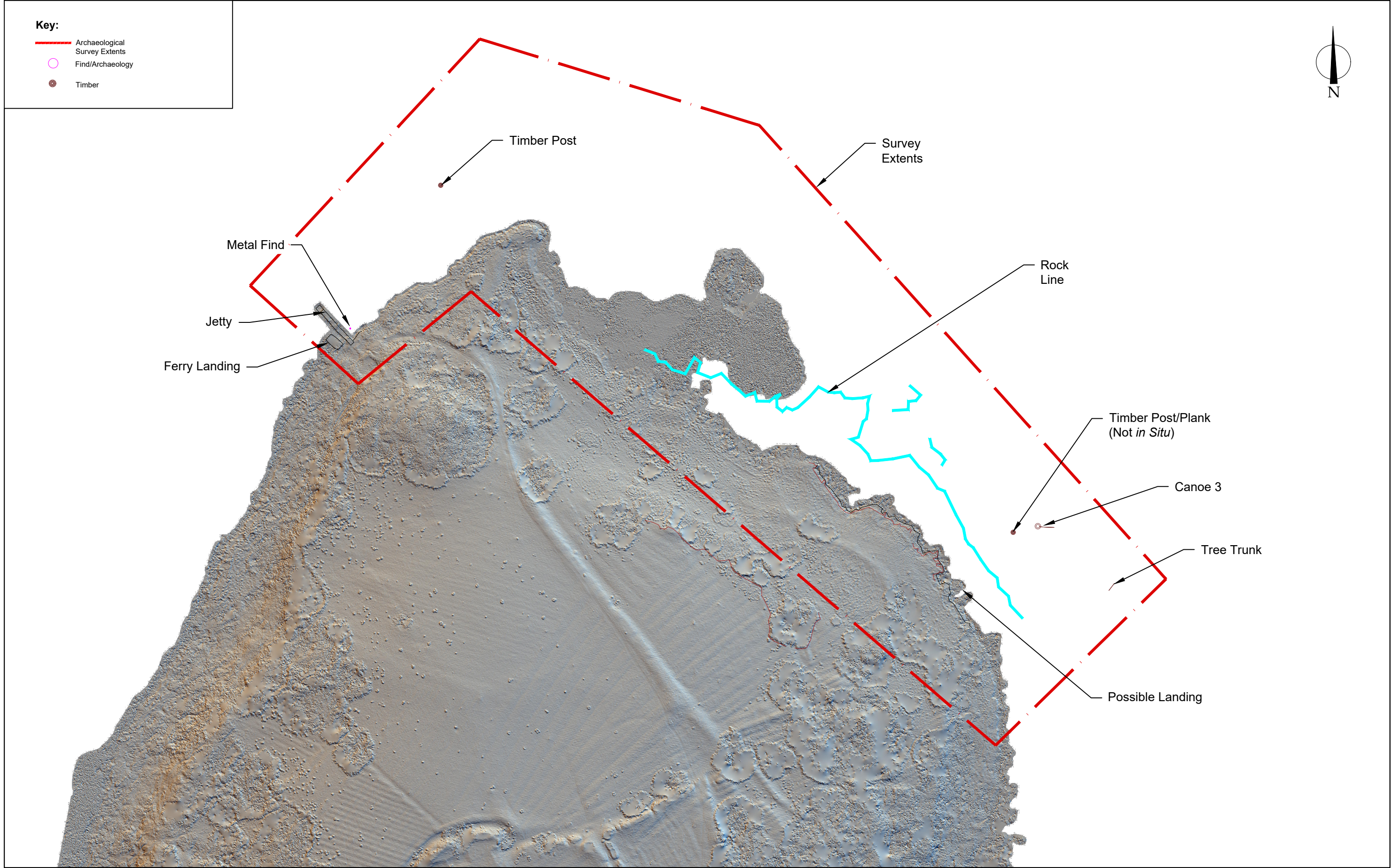
Date
16.06.21

Scale
1:1:5000

Drawing No.
Figure 3



	Notes Figure adapted from Control Surveys' Topographical Survey map ref: 16-142-01 Survey performed using DGPS and Total Station		A3	Job/Exc No. 21D0019	Drawn by D.Copeland	CAD reference Inis_Cealtra	Client Archaeological Projects Ltd. for McCullough Mulvin for Clare County Council	Title Figure 4 - Plan View Showing Underwater Archaeological Survey Area and Features Noted
				Date 22.06.21	Scale 1:1500	Drawing No. Figure 4	Project Inis Cealtra (Holy Island) Visitor Experience Project	



Notes

Figure adapted LiDAR Imagery (Source: Steve Davis, UCD)
Survey performed using DGPS and Total Station

A3

Job/Exc No.
21D0019

Date
22.06.21

Drawn by
D.Copeland

Scale
1:1500

CAD reference
Inis_Cealtra

Drawing No.
Figure 5

Client
Archaeological Projects Ltd. for McCullough Mulvin for Clare County Council

Project
Inis Cealtra (Holy Island) Visitor Experience Project

Title
Figure 5 - Plan View Showing Underwater Archaeological Survey Area and LiDAR Underlay

APPENDIX 14.4

INIS CEALTRA CO. CLARE

INIS CEALTRA ARCHAEO-GEOPHYSICAL SURVEY



VOLUME III

APPENDICES TO

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

Inis Cealtra

Archaeo-geophysical survey report

January 2024



NOTES

Survey type	Multibeam Echosounder, Marine Magnetometer, Sidescan Sonar
Survey date	January 2024
Revision	Rev 0
Report date	17/01/2024
Location	Inis Cealtra Lough Derg, Co Clare.
Projection	ITM and Geographic-WGS84

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1. Introduction

Hydromaster conducted an Archaeo-geophysical survey (acoustic and magnetic) in Inis Cealtra, Lough Derg in County Clare.

The survey area cover a buffer of 100 m around the Inis Cealtra .

The survey was to detect and map features on the seabed and highlight those most likely to be archaeology or requiring further investigation/diver inspection (all features remain included in the primary list).

The survey was completed on 11th, 12th, 14th and 16th of January 2023.

The survey presented some access difficulties relating to dense vegetation (reeds) in some places and shallow waters around the island.

2. Executive summary

Data quality was good in general with abundant features recorded. Fifteen targets have been identified has potential archaeology: possible logboats (targets AT1-SSS1, AT4-SSS40, AT12-SSS52, AT17, AT20-SSS48, SSS54, SSS63, SSS64, SSS65, SSS68, SSS71, SSS75, SSS76, SSS77, SSS78) as shown in figure 1 and 2.

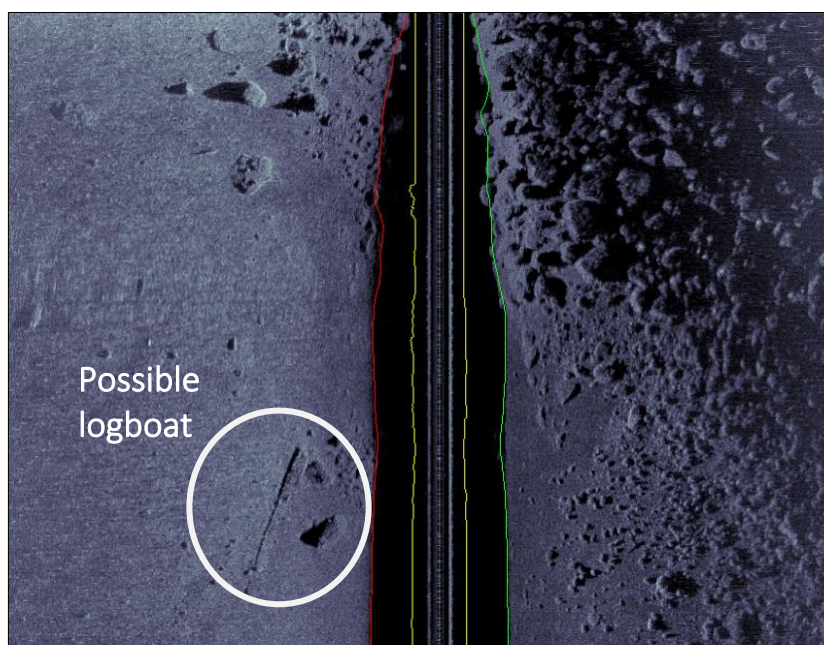
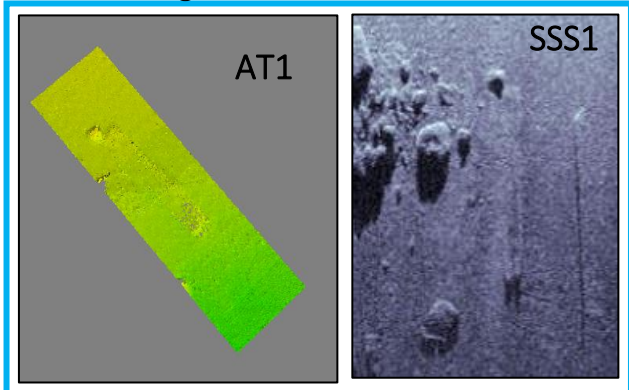


Figure 1: Example of sidescan data showing a possible logboat and boulders



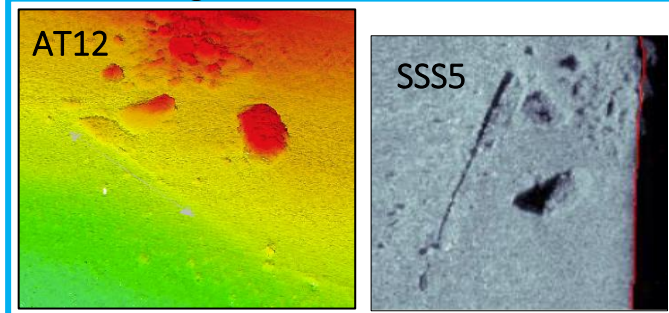
Possible Logboat 1



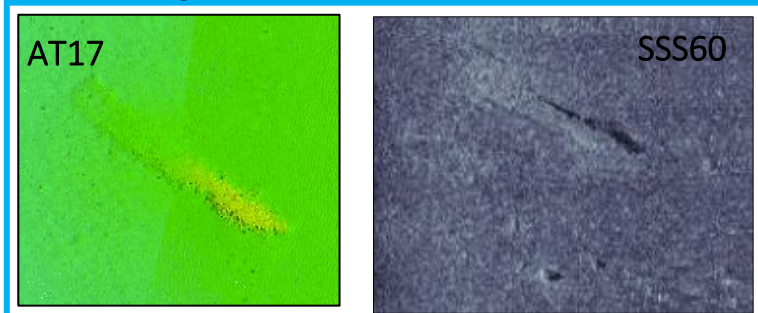
Possible Logboat 2



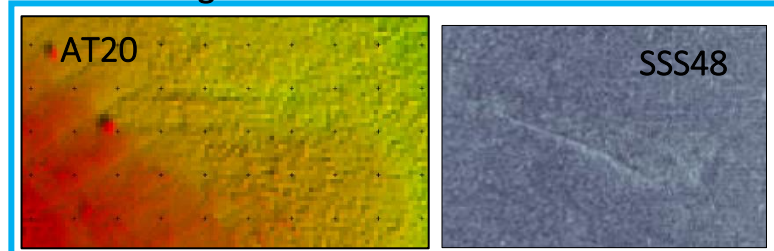
Possible Logboat 3



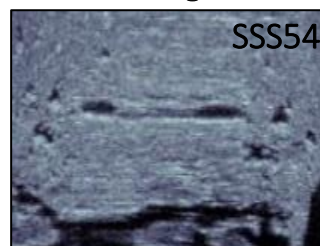
Possible Logboat 4



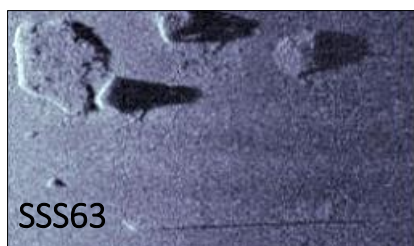
Possible Logboat 5



Possible Logboat 6



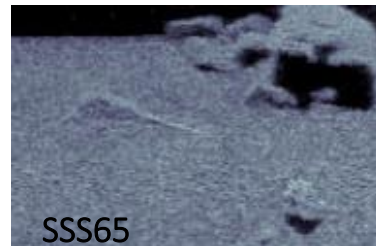
Possible Logboat 7



Possible Logboat 8

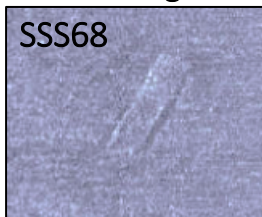


Possible Logboat 9

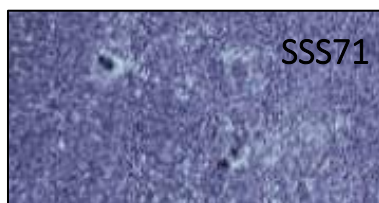




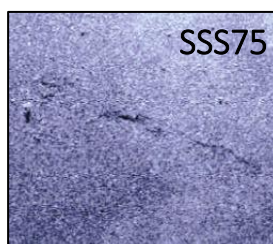
Possible Logboat 10



Possible Logboat 11



Possible Logboat 12



Possible Logboat 13



Possible Logboat 14



Possible Logboat 15



Figure 2: Potential logboat identified in the MBES data (color) and/ or in the SSS data (grey)



3. Survey methodology

The survey was carried out with a line spacing to ensure a full seabed coverage and at slow speed for optimum data quality.

The multibeam echosounder (MBES) and the sidescan sonar were pole mounted due to the shallow water and conducted simultaneously with the Autonomous Survey Vessel (ASV). The Magnetometer was towed behind the vessel.

3.1. Survey area & tracklines

Figure 2 presents the survey area (white polygon) and the survey tracklines (yellow lines).



Figure 3: Survey area and tracklines

—



3.2. Survey equipment

- MULTIBEAM ECHOSOUNDER (MBES)

A high resolution multibeam echosounder (Norbit iWBMS) was operated at 400kHz. The specifications of the multibeam echosounder are the following:

Frequency: 400kHz

Number of beams: 512

Resolution: 0.9° @400kHz

Sample Rate: up to 60Hz

Range resolution: <10mm @400kHz

- MARINE MAGNETOMETER

A marine magnetometer (Geometrics G-882) was used for the magnetic survey. The G-882 marine magnetometer was towed behind the vessel. The specifications of the magnetometer are the following:

Operating Range: 20,000 to 100,000nT

Max Sample Rate: 20Hz

Noise: <0.004nT/Hz RMS

- SIDESCAN SONAR (SSS)

A high frequency (1000kHz) sidescan sonar was used during survey operations. The Sidescan sonar was vessel mounted for the duration of the survey due to shallow water depths. The specifications of the sonar are the following:

Frequency: 1000 kHz

Swathe coverage: 70m (35m on each channel)

Acoustic beam widths: 0.3°



4. Survey results

4.1. Bathymetry

Water depths range from 20.6 m to 30.5 m Ordnance Datum with the seabed gently sloping away from the Island and toward the south. See figure 4.

Detailed bathymetric chart in Appendix 1.

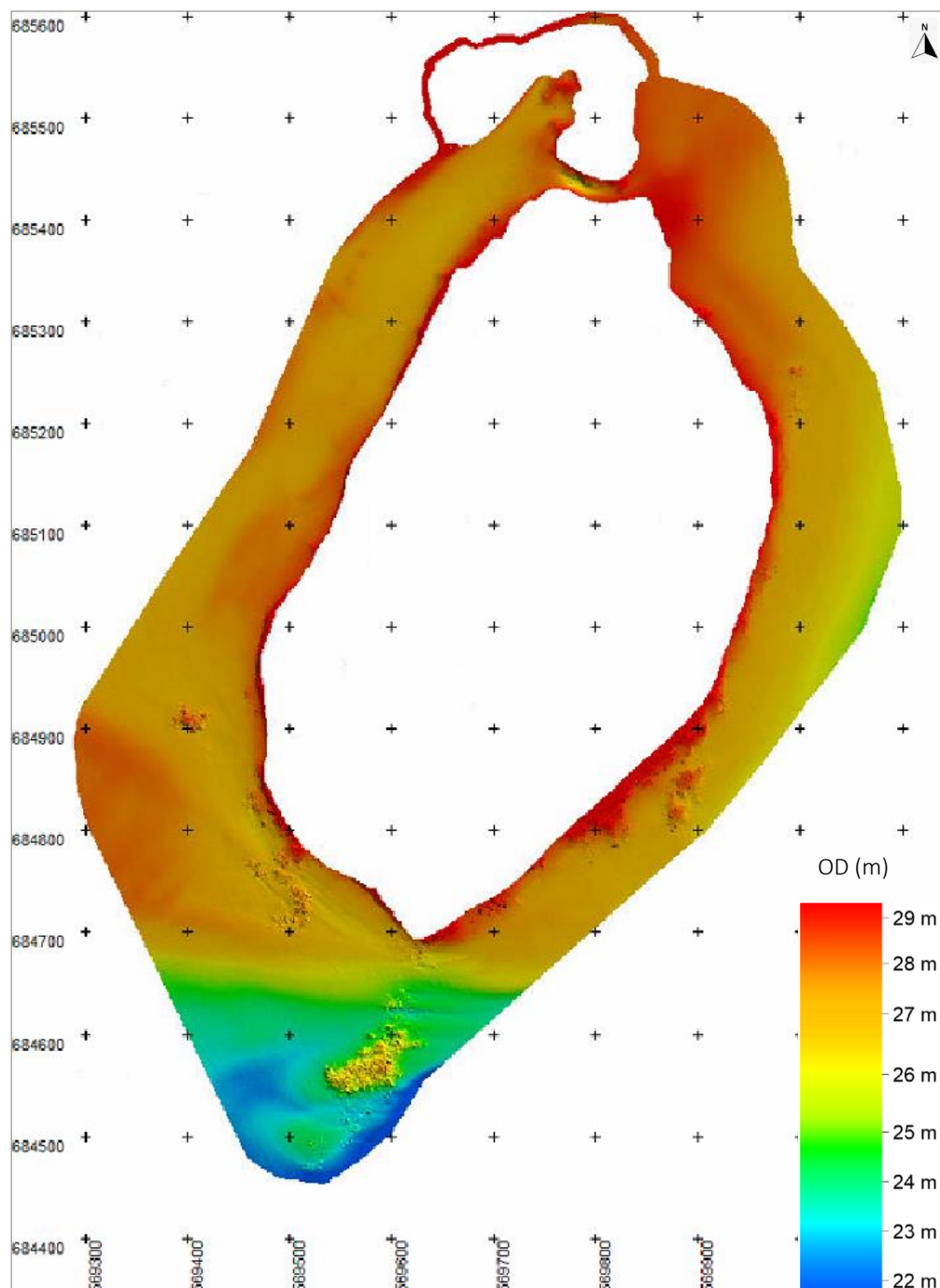


Figure 4: Inis Cealtra Bathymetry (OD)



4.2. Acoustic targets

Targets are identified where there are anomalies in the acoustic data of an area or where a return has man-made characteristics. Anything which is identified as not corresponding with its natural surrounding may be marked as a target. Positive identifications are based on the acoustic data in conjunction with any other information but should be subject to visual inspection for certainty.

4.2.1. MBES acoustic targets

In total, 21 acoustic targets have been identified in the MBES data, as presented figure 5. Coordinates, dimensions and description of the targets are listed in table 1. *Detailed MBES target location chart in Appendix 1.*

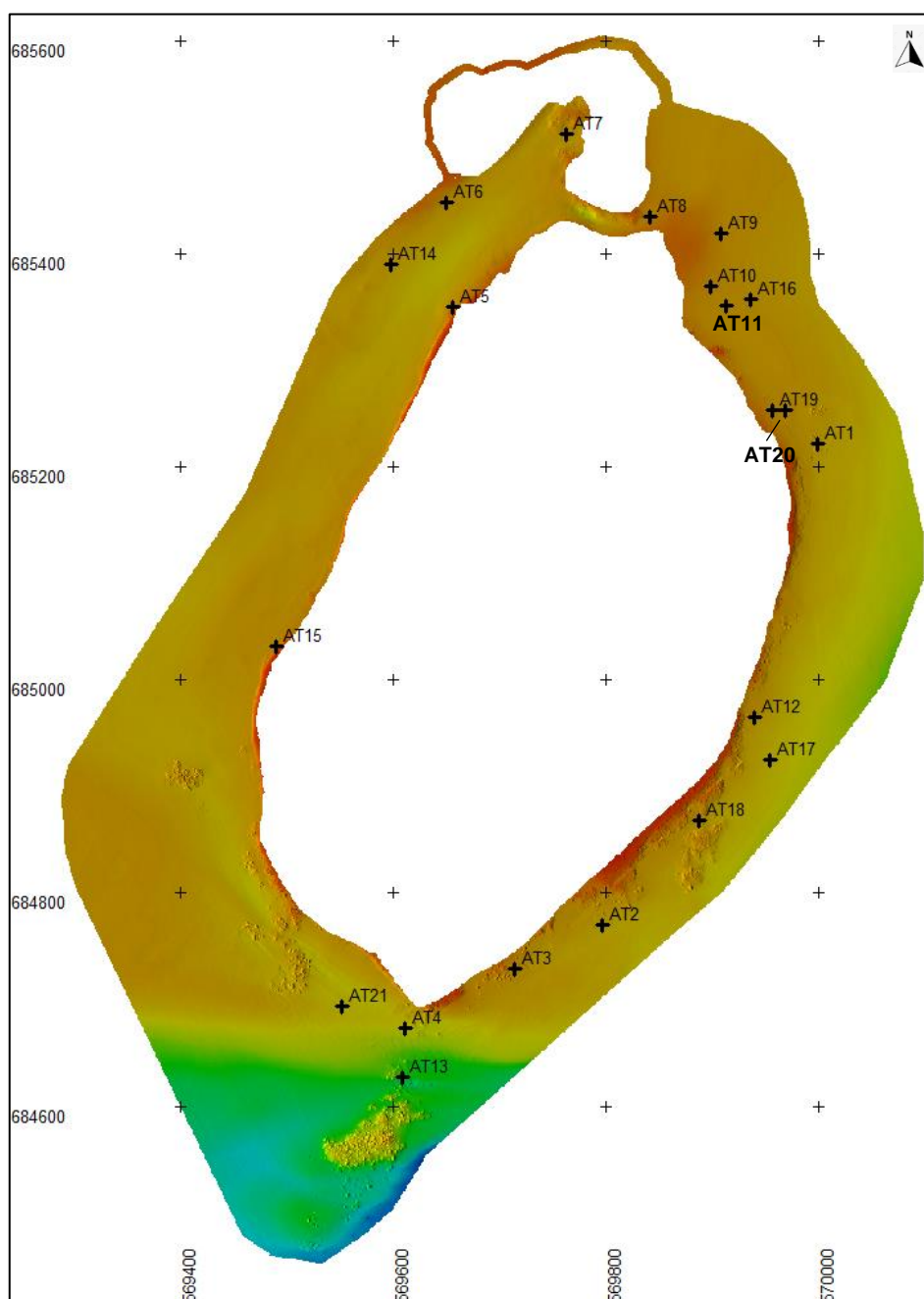


Figure 5: MBES target location



Table 1: MBES Acoustic targets list (ITM coordinates)

Target ID	Easting (m)*	Northing (m)*	Length (m)	Width (m)	Description
AT1	569998.1	685221.7	5.1	1.0	NI long debris, Possible logboat
AT2	569796.4	684769.9	1.7	0.8	NI debris – possible boulder
AT3	569714.5	684728.5	3.2	0.9	NI long debris, possible boulder
AT4	569611.4	684673.4	5.4	0.8	NI long debris, possible logboat
AT5	569655.5	685350.0	0.0	0.0	Field of tyres
AT6	569649.9	685448.2	0.7	0.4	NI sticking out debris
AT7	569762.5	685512.4	1.5	1.0	NI debris, possible boulders
AT8	569840.7	685435.0	1.5	0.5	NI debris, possible boulder
AT9	569908.4	685419.5	0.4	0.2	NI debris
AT10	569898.4	685369.5	4.7	3.3	NI long debris, possible rope
AT11	569912.5	685350.9	13.0	4.8	NI long debris, possible rope
AT12	569939.4	684965.4	6.2	0.8	NI long debris, possible logboat
AT13	569608.6	684627.2	22.0	0.2	Possible mooring, blocks and rope/chain
AT14	569597.3	685389.6	4.5	0.5	NI long debris
AT15	569490.3	685031.1	10.4	0.2	NI long debris, possible tree
AT16	569935.5	685357.1	8.0	0.1	NI long debris, possible rope
AT17	569953.6	684925.2	4.3	0.6	NI long debris – Possible logboat
AT18	569887.0	684867.8	4.6	2.6	Possible big boulder
AT19	569956.6	685253.2	1.5	1.0	NI debris, possible anchor
AT20	569967.9	685253.6	4.3	0.9	NI long debris, possible logboat
AT21	569551.2	684694.4	5.1	0.8	NI long scours

*Coordinates in Irish Transverse Mercator (ITM)

** NI: Not Identified



Pictures of the MBES targets are presented in Appendix 2.

Figure 6 shows a few of the identified targets representing possible logboats (AT1, AT4, AT12, AT17, AT20) and a mooring with blocks and ropes (AT13).

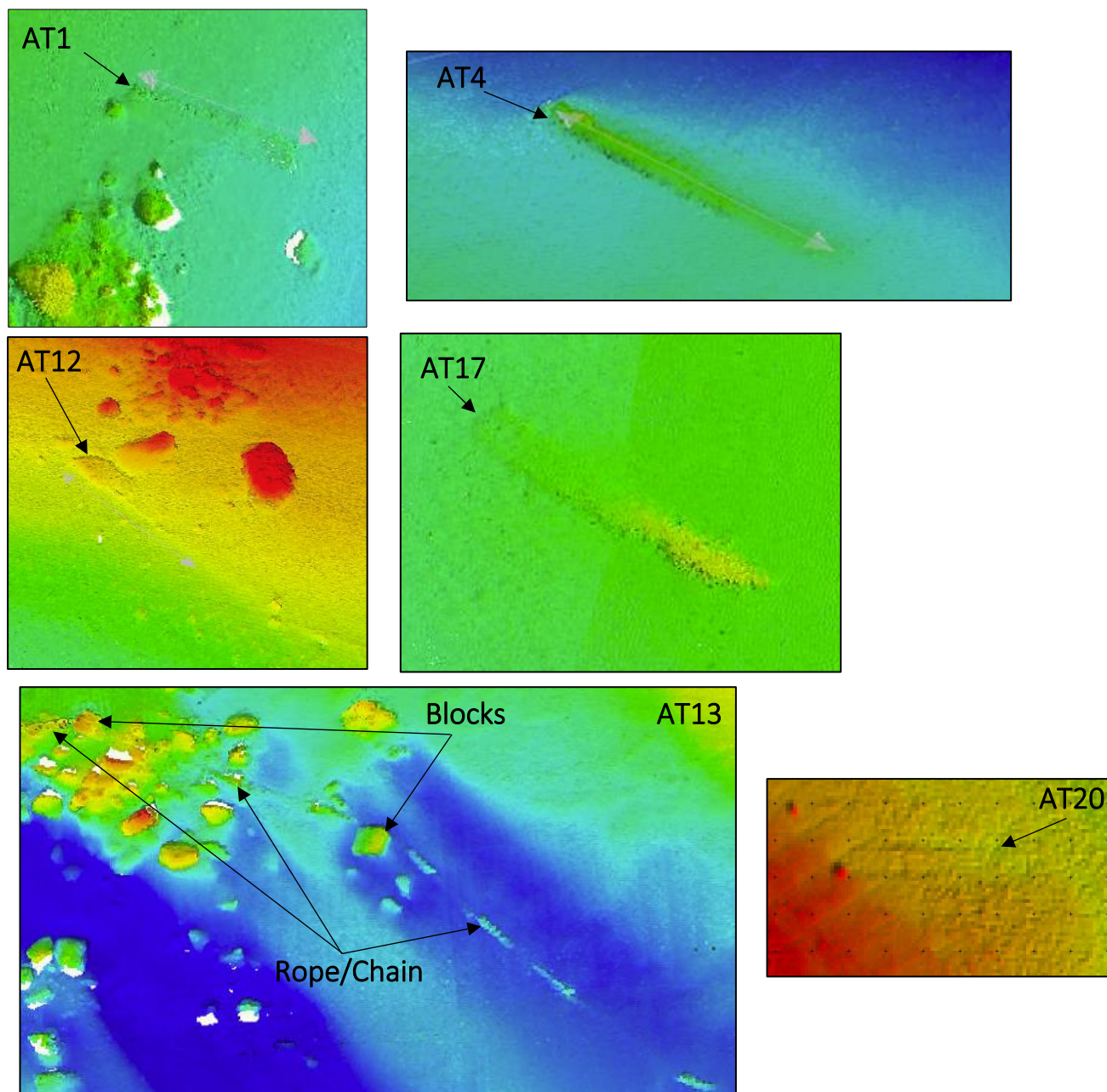


Figure 6: Example of a few MBES identified targets (AT1, AT4, AT12, AT17, AT13, AT20)



4.2.2. SSS acoustic targets

In total, 80 sonar contacts have been identified in the SSS data, as presented figure 7. Coordinates, dimensions and description of the targets are listed in table 2. *Detailed SSS target location chart in Appendix 1.*

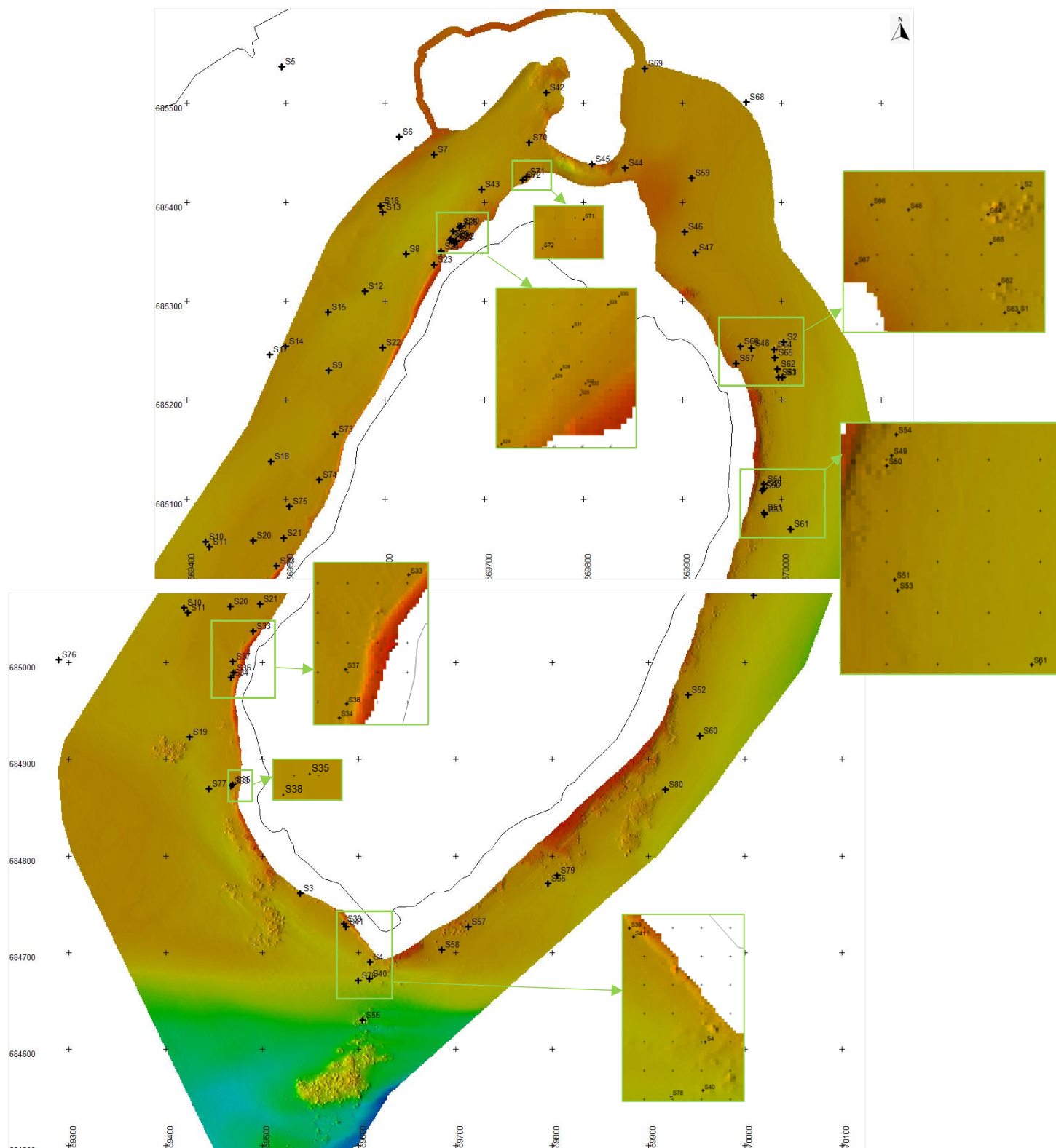


Figure 7: SSS target location



80 sonar contacts have been listed on table 2.

Table 2: Sidescan sonar contact list (ITM coordinates)

ID	Easting	Northing	Length (m)	Width (m)	Description
SSS01	570000.6	685223.5	5.3	1.1	NI debris , Possible logboat
SSS02	570001.7	685259.1	1.6	0.6	NI debris, possible boulder
SSS03	569539.3	684761.6	2.0	0.6	NI long debris
SSS04	569611.3	684690.0	1.1	0.1	NI debris
SSS05	569495.4	685537.3	0.9	0.4	NI debris
SSS06	569614.2	685466.6			NI debris
SSS07	569649.3	685448.6	1.1	0.4	NI sticking out debris
SSS08	569620.9	685348.0	2.4	0.4	NI long debris
SSS09	569543.1	685230.2	0.6	0.2	NI debris
SSS10	569418.8	685057.1	0.4	0.2	NI debris
SSS11	569422.6	685051.6	1.0	0.1	NI debris
SSS12	569579.6	685310.2	0.6	0.4	NI debris, possible boulder
SSS13	569597.1	685390.5	2.2	0.2	NI long debris
SSS14	569499.4	685254.8	0.8	0.2	NI debris
SSS15	569542.5	685289.3	0.5	0.4	NI debris, possible tyre
SSS16	569595.4	685396.8	0.9	0.3	NI debris
SSS17	569483.4	685246.5	0.7	0.1	NI debris
SSS18	569484.7	685138.3	1.7	0.7	NI debris
SSS19	569424.8	684923.3	2.0	0.2	NI long debris
SSS20	569466.5	685057.9	1.1	0.4	NI long debris
SSS21	569497.4	685061.0	1.1	0.3	NI long debris
SSS22	569597.6	685253.5	2.2	0.2	NI long debris
SSS23	569649.2	685337.2	0.6	0.6	Tyre
SSS24	569655.9	685350.5	0.7	0.7	Field of tyres
SSS25	569669.8	685359.1	0.7	0.7	Tyre
SSS26	569674.7	685375.0	1.5	0.1	NI long debris
SSS27	569670.7	685361.1	0.7	0.7	Tyre
SSS28	569666.4	685363.6	0.7	0.7	Tyre
SSS29	569665.1	685362.0	0.6	0.6	Tyre
SSS30	569676.6	685376.5	1.8	0.1	NI long debris
SSS31	569668.5	685371.1	0.6	0.1	NI long debris
SSS32	569671.5	685360.7	0.7	0.7	Tyre
SSS33	569490.5	685032.9	10.1	1.2	NI long debris, possible tree
SSS34	569467.2	684984.8	3.0	0.4	NI long debris
SSS35	569469.3	684874.2	1.2	0.2	NI long debris
SSS36	569469.7	684989.5	1.0	0.2	NI debris
SSS37	569469.4	685001.0	0.7	0.2	NI debris
SSS38	569467.1	684872.5	4.7	0.2	NI long debris
SSS39	569584.8	684729.9	2.5	0.2	NI long debris
SSS40	569610.5	684673.1	5.8	0.2	NI long debris, possible logboat



SSS41	569586.3	684726.8	4.3	0.2	NI long debris
SSS42	569762.5	685511.2	1.5	0.9	NI debris, possible boulders
SSS43	569697.3	685413.2	1.8	0.2	NI long debris
SSS44	569842.0	685435.3	0.8	0.8	NI debris, possible boulder
SSS45	569808.5	685439.2	0.7	0.7	Tyre
SSS46	569901.9	685370.7	17.0	0.2	NI long debris, possible rope
SSS47	569912.9	685349.5	10.0	0.4	NI long debris, possible rope
SSS48	569969.0	685252.9	4.7	0.7	NI long debris, possible logboat
SSS49	569981.0	685110.8	1.9	1.0	NI debris, possible boulder
SSS50	569980.0	685108.8	1.0	0.2	NI debris, possible boulder
SSS51	569981.6	685086.5	0.5	0.5	Tyre
SSS52	569941.1	684966.9	6.0	0.7	NI long debris, possible logboat
SSS53	569982.2	685084.4	0.6	0.6	Tyre
SSS54	569981.9	685114.9	2.4	0.2	NI long debris, possible logboat
SSS55	569603.5	684630.4	24.0	6.0	Possible mooring: two blocks and rope/chain
SSS56	569795.6	684771.4	5.0	1.5	NI debris, possible boulder
SSS57	569712.9	684726.5	3.1	1.0	NI long debris, possible boulder
SSS58	569685.7	684702.9	2.3	0.1	NI long debris
SSS59	569908.7	685425.1	5.0	1.0	NI long debris
SSS60	569953.1	684924.2	5.3	1.0	NI long debris, possible logboat
SSS61	570008.4	685069.9	17.0	1.0	Long NI debris, possible rope or scar
SSS62	569995.1	685231.5	6.0	0.7	NI Long debris, possible boulder
SSS63	569996.7	685223.4	5.5	0.9	NI long debris, possible logboat
SSS64	569991.8	685251.6	2.5	0.8	NI long debris, possible logboat half buried
SSS65	569992.6	685243.3	4.5	0.7	NI long debris, possible logboat half buried
SSS66	569958.4	685254.3	3.0	0.3	NI long debris
SSS67	569953.9	685237.5	5.0	1.0	NI long debris, possible mooring
SSS68	569963.9	685501.7	4.2	0.9	NI long debris, possible logboat
SSS69	569861.4	685535.6	3.1	0.5	NI long debris
SSS70	569745.3	685460.6	7.2	1.7	NI long debris or scar
SSS71	569742.8	685425.9	3.4	0.7	NI long debris, possible logboat half buried
SSS72	569738.8	685423.1	5.0	0.5	NI long debris
SSS73	569549.4	685165.7	3.0	1.0	NI long debris or scar
SSS74	569533.0	685119.8	4.2	0.4	NI long debris
SSS75	569503.3	685092.6	6.0	0.9	NI long debris, possible logboat or scar
SSS76	569288.9	685003.1	5.6	0.7	NI long debris, possible logboat or scar
SSS77	569444.3	684869.1	4.2	0.8	NI long debris, possible logboat
SSS78	569599.4	684671.0	5.9	1.4	NI long debris, possible logboat
SSS79	569805.0	684779.7	5.1	0.4	NI long debris
SSS80	569917.2	684868.7	25.0	0.3	Possible mooring: one block and rope/chain or scour

*Coordinates in Irish Transverse Mercator (ITM)

** NI: Not Identified



Pictures of all the sonar contacts are presented in Appendix 2.

Figure 8 below is showing a few of the identified contacts representing a few of the possible logboats (SSS1, SSS40, SSS48, SSS52, SSS60, SSS63, SSS64, SSS65, SSS68, SSS71, SSS75, SSS76, SSS77, SSS78) and a mooring (SSS55).

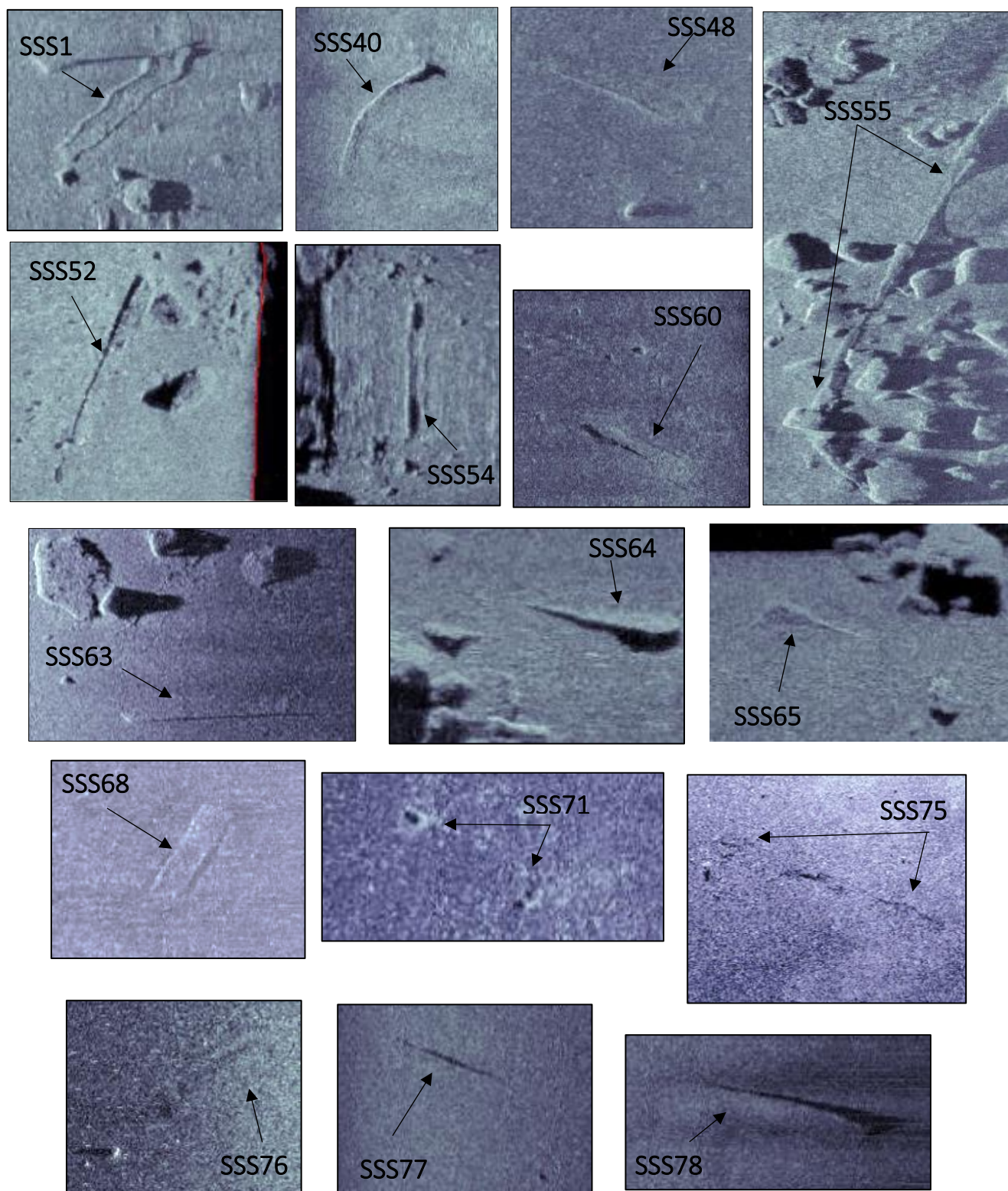


Figure 8: Pictures of sonar contacts showing possible logboats (SSS1, SSS40, SSS48, SSS52, SSS60, SSS63, SSS64, SSS65, SSS68, SSS71, SSS75, SSS76, SSS77, SSS78) and a mooring (SSS55)

4.3. Marine magnetometer

The area around the island and the NE of the survey area were not suitable for towed magnetometers due to reeds or shallow waters, as shown in figure 9.

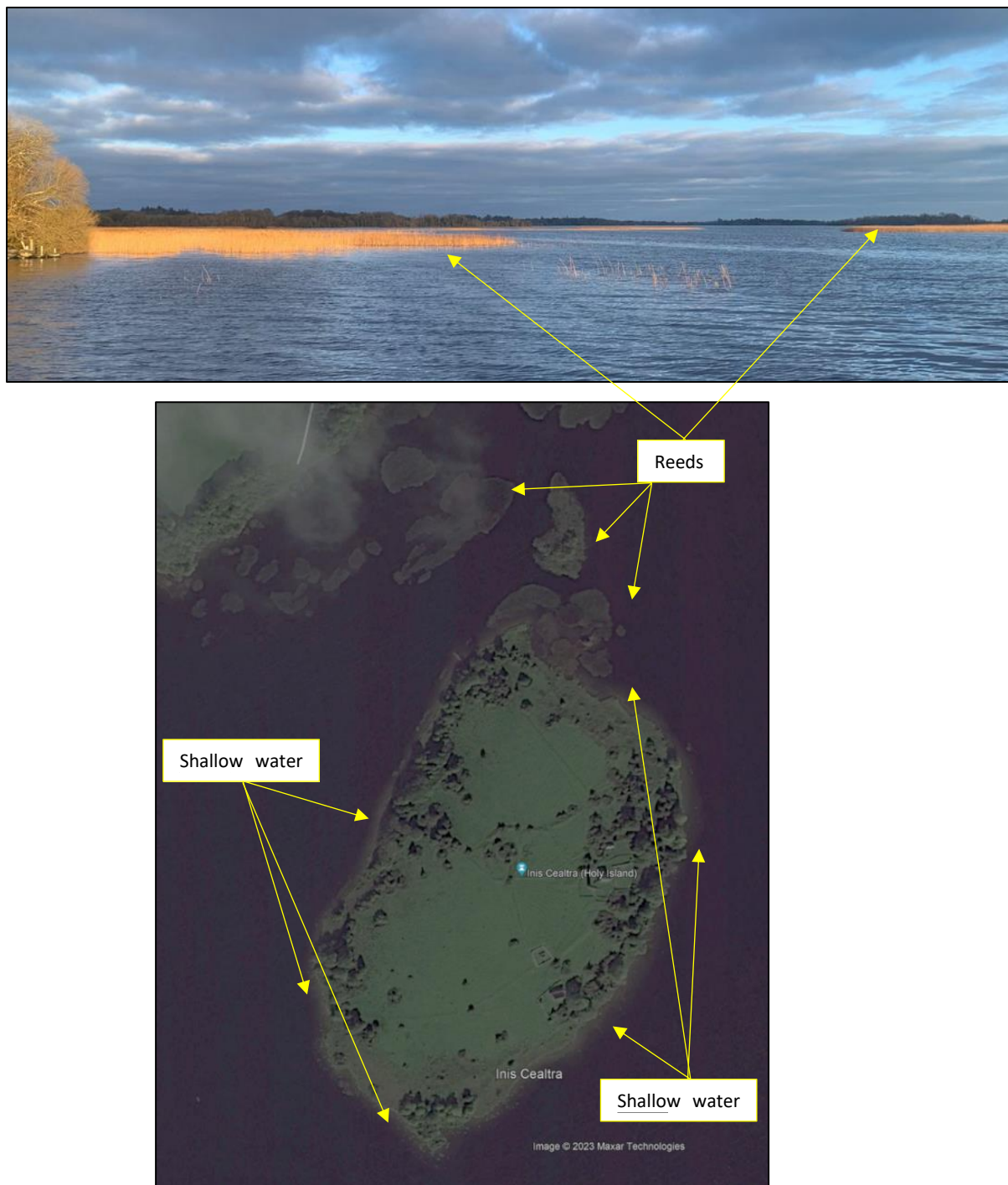


Figure 9: Areas not suitable for towed magnetometer highlighted in yellow.



In total, 11 magnetometer anomalies were identified, see figure 10 and listed in table 3.
Detailed MBES target location chart in Appendix 1.

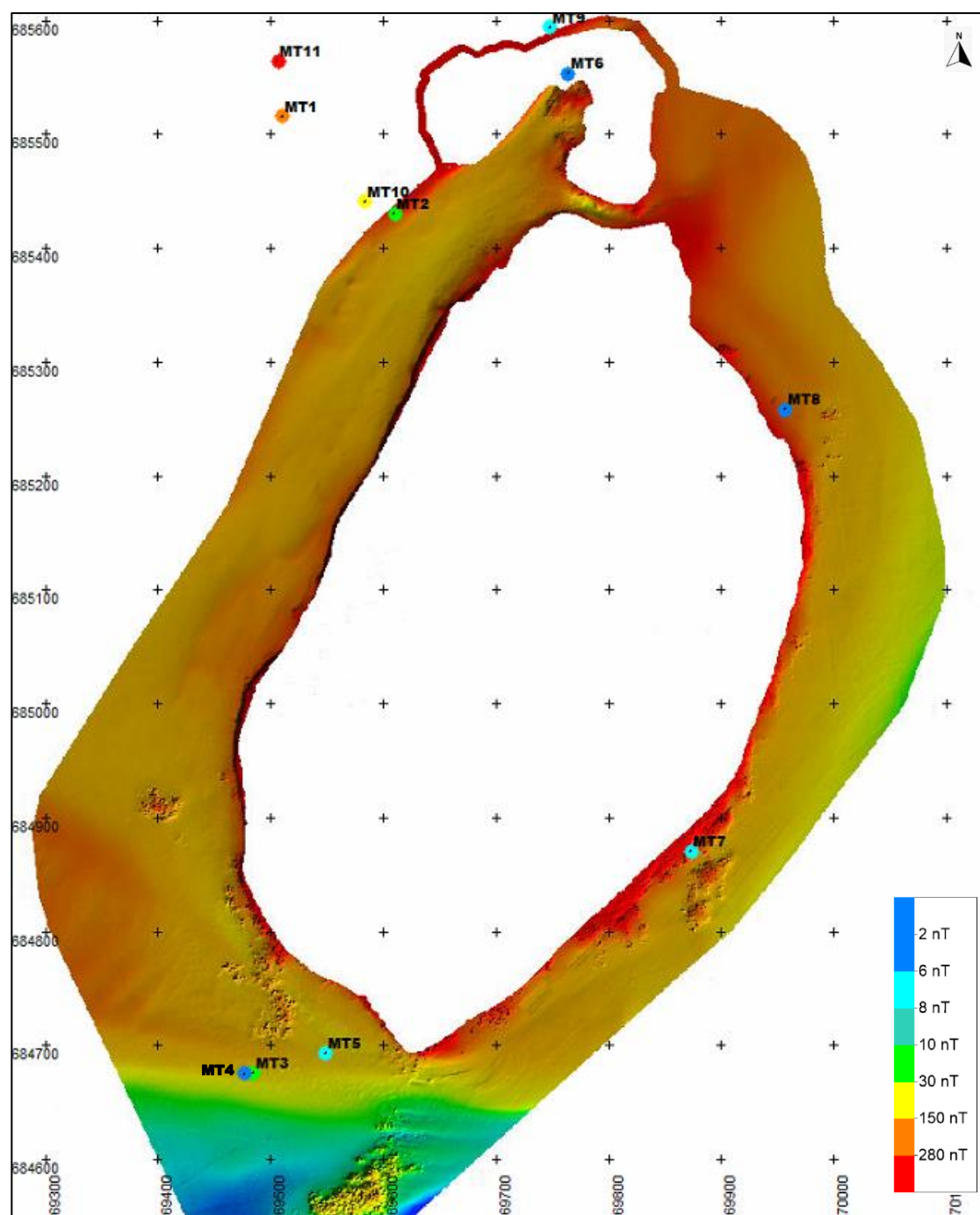


Figure 10: Magnetic anomalies location



Table 3 is listing the 11 magnetic anomalies identified.

Table 3: Magnetic anomalies list (ITM coordinates)

Target ID	Easting (m)*	Northing (m)*	Amplitude (nT)**
MT1	569510.3	685515.8	168.7
MT2	569637.6	685441.8	11.5
MT3	569484.8	684675.8	13.5
MT4	569476.4	684675.0	2.3
MT5	569548.5	684693.8	6.3
MT6	569764.1	685553.5	2.2
MT7	569872.9	684870.4	7.1
MT8	569957.1	685258.4	3.0
MT9	569747.5	685594.0	7.4
MT10	569583.2	685441.3	39.2
MT11	569506.0	685564.5	289.7

*Coordinates in Irish Transverse Mercator (ITM)

** Amplitude of the target in Nanotesla (nT)

Figure 11 presents two example of magnetic anomalies recorded at 168 nT (MT1) and at 40 nT (MT10) . The vertical axis corresponds to the magnetic Amplitude in nT, and the horizontal axis to the time.

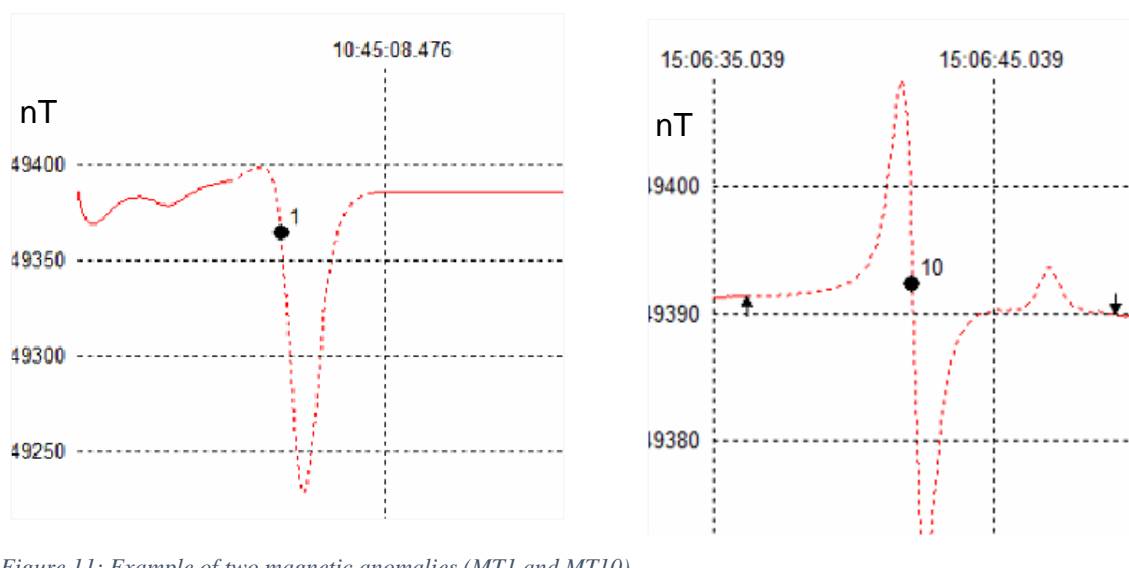




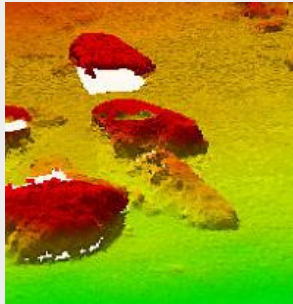
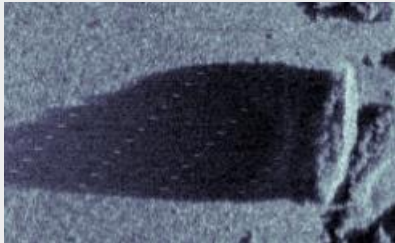




Figure 11: Example of two magnetic anomalies (MT1 and MT10)

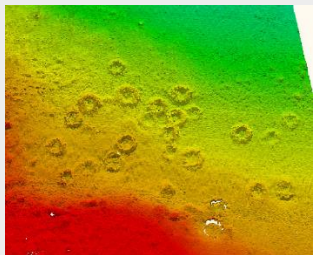
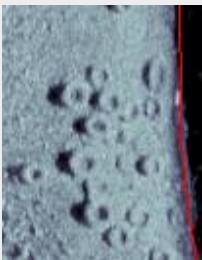


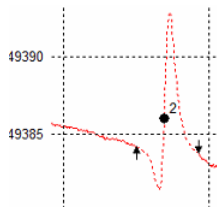

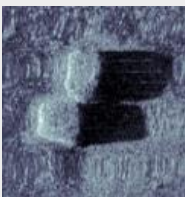

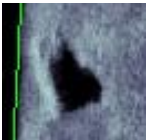
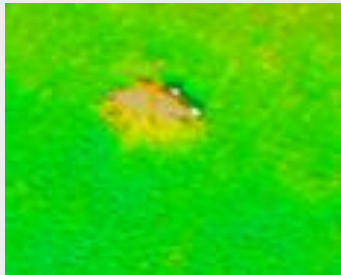



4.4. Target cross correlation

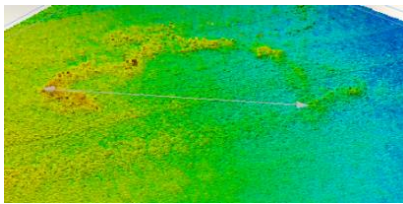

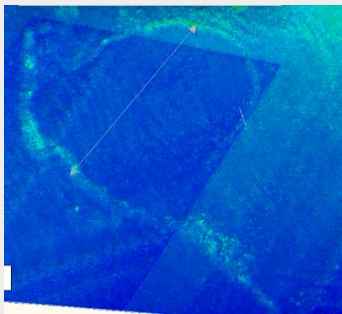
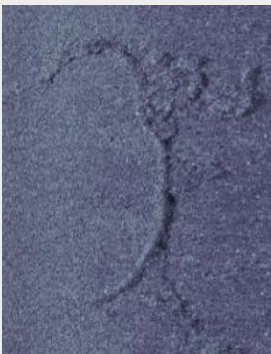
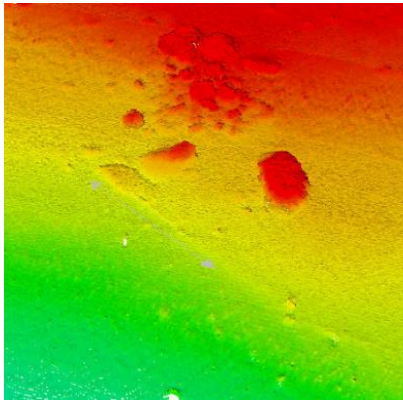

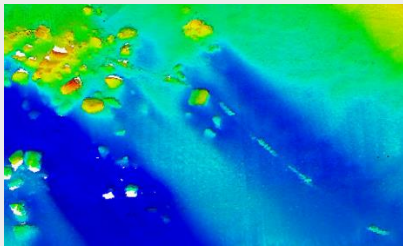
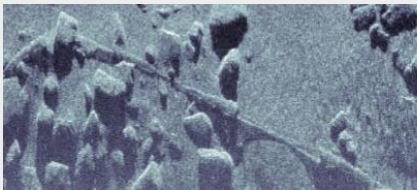
Table 4: Cross correlation between MBES, SSS and Magnetic targets.

MBES Target ID	SSS contact ID	Magnetometer anomaly ID	Description
AT1 	SSS1 	None	Possible logboat
AT2 	SSS56 	None	NI debris, Possible boulder
AT3 	SSS57 	None	NI debris, Possible boulder
AT4 	SSS40 	None	NI debris, Possible logboat

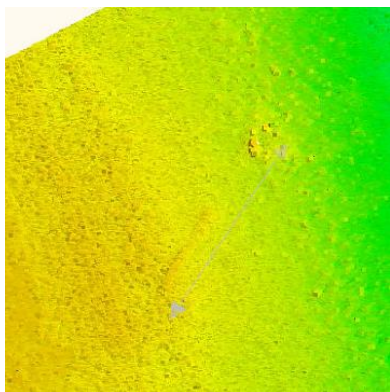
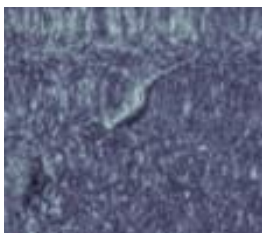

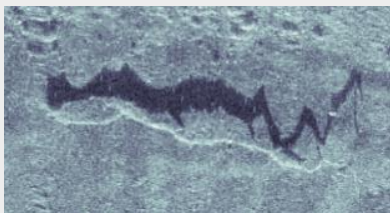


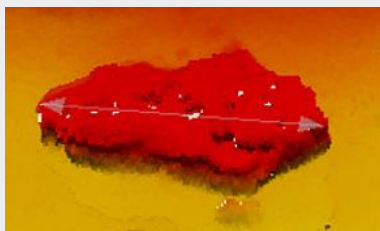
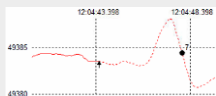


AT5	SSS24	None	Field of tyres
			
AT6	SSS7	MT2	NI debris, sticking out
			
AT7	SSS42	None	NI debris x2, Possible boulders
			
AT8	SSS44	None	NI debris, Possible boulder
			
AT9	SSS59	None	NI debris, Possible boulder
			

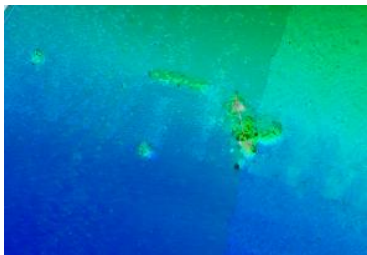

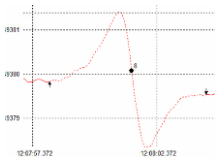
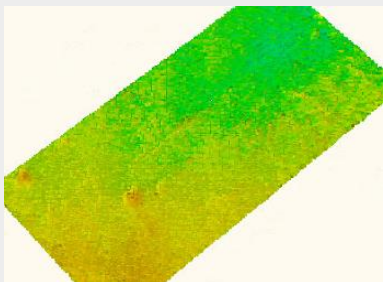

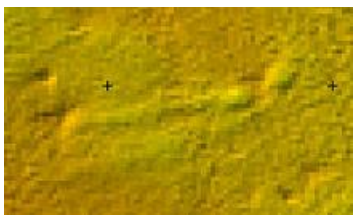
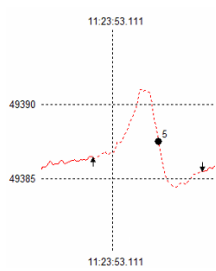


AT10	SSS46	None	NI long debris, possible rope
			
AT11	SSS47	None	NI long debris, possible rope
			
AT12	SSS52	None	NI long debris, Possible logboat
			
AT13	SSS55	None	Possible mooring with two blocks and rope/chain
			



AT14	SSS13	None	NI long debris
			
AT15	SSS33	None	NI long debris, possible tree/ branch
			
AT17	SSS60	None	NI long debris, Possible logboat
			
AT18	None	MT7	NI Debris, Possible boulder.
			



<p>AT19</p> 	<p>SSS66</p> 	<p>MT8</p> 	<p>NI long broken debris</p>
<p>AT20</p> 	<p>SSS48</p> 	<p>None</p>	<p>NI long debris, Possible logboat</p>
<p>AT21</p> 	<p>None</p>	<p>MT5</p> 	



Appendix

Appendix 1: Charts (PDF format)

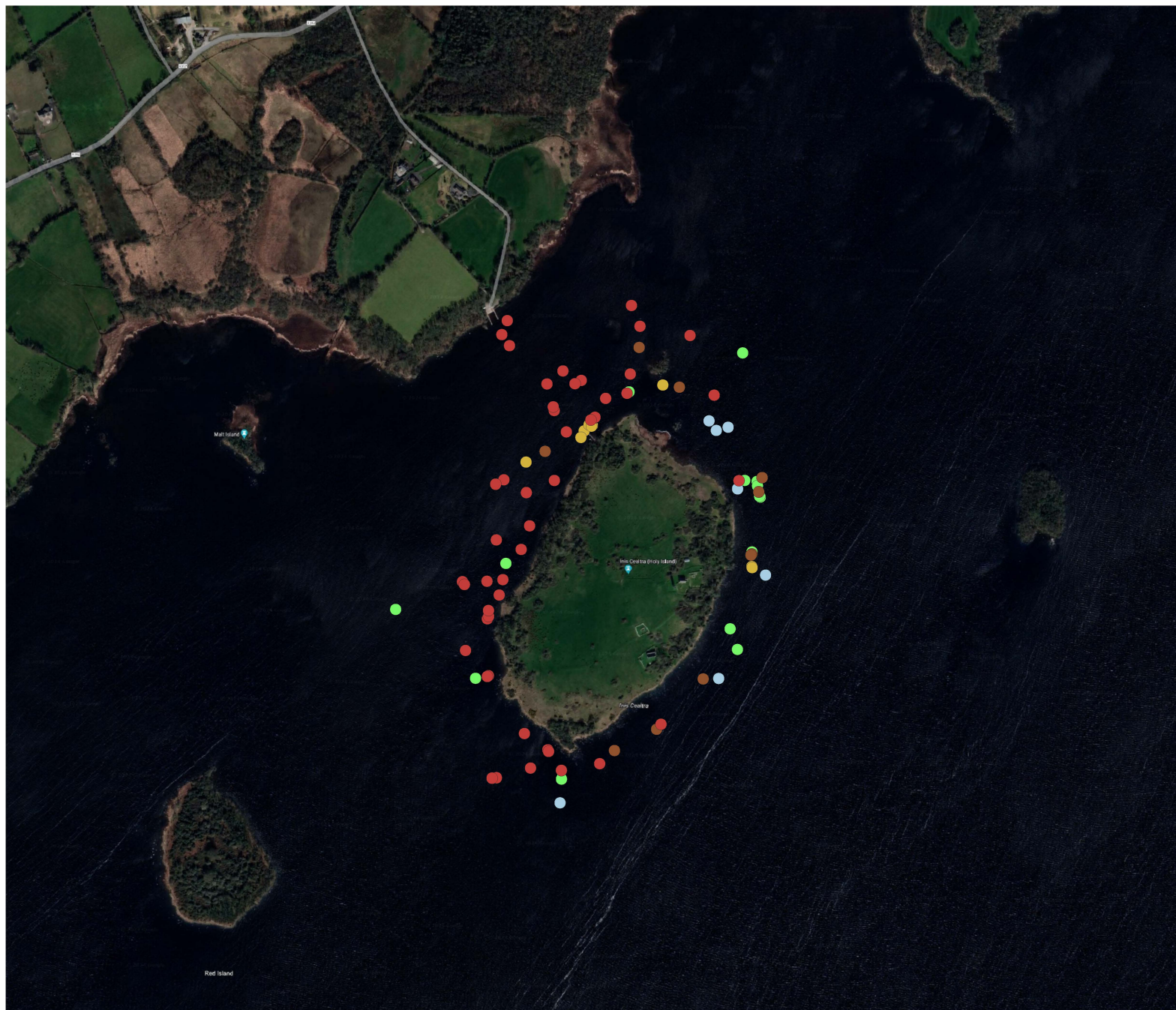
- Bathymetric charts: 2401_InisCealtra_Bathymetric_Chart.pdf
- Targets location: 2401_InisCealtra_Targets_Chart.pdf

Appendix 2: Target pictures (PDF format)

- MBES target pictures: 2401_InisCealtra_MBES_targets_Pictures.pdf
- SSS target pictures: 2401_InisCealtra_Sidescan_contacts_Pictures.pdf

Appendix 3: Target lists (CSV & DXF format)

- MBES targets: 2401_MBES_Acoustic_Targets_List_ITM.csv
2401_InisCealtra_MBES_Targets_ITM.dxf
- SSS targets: 2401_SSS_Contact_List_ITM.csv
2401_InisCealtra_SSS_Contacts_ITM.dxf
- Magnetic targets: 2401_Magnetic_Anomalies_List_ITM.csv
2401_InisCealtra_Magnetic_Anomalies_ITM.dxf



Legend

- NI debris
- Possible boulders
- Ropes and mooring
- Tyres
- Possible Logboats

Project:

Underwater Archaeological Impact
Assessment
Inis Cealtra
Lough Derg
Co. Clare



0 100 200 m



Drawing Title:

Geophysical Anomaly Locations

Produced by: C. Haskins

mizen
ARCHAEOLOGY



Legend

● Possible Logboats

Project:

Underwater Archaeological Impact
Assessment
Inis Cealtra
Lough Derg
Co. Clare



0 100 200 m



Drawing Title:

Possible Logboat Locations

Produced by: C. Haskins

Date: Feb. 2024

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ARCHAEOLOGY

APPENDIX 14.5

UNDERWATER ARCHAEOLOGICAL IMPACT ASSESSMENT



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024

PROJECT

Visitor Experience Project, Inis Cealtra (Holy Island),
Co. Clare

SCOPE

Underwater Archaeological Impact Assessment (UAIA)

CLIENT

McCullough Mulvin Architects

PREPARED BY

Dr Carolyn Howle Outlaw and Julianna ODonoghue

DATE

September 2024

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Summary

Mizen Archaeology carried out an Underwater Archaeological Impact Assessment of the proposed improved landing facilities at Iniscealtra (Holy Island), Co. Clare. Iniscealtra is a small island in Lough Derg which contains the well-preserved remains of a medieval church complex, earthworks and enclosures. The assessment included a desktop study, a geophysical survey, and a dive survey. Four logboats were identified. These were previously reported by local divers in 2011. Descriptions provided in the 2011 report indicate that the interior of the vessels were somewhat exposed during that survey. Mizen Archaeology found the vessels to be largely buried, and in the absence of excavation no detailed description of the interior features, the tools or techniques used in its construction can be presented.

The assessment recommends the following mitigation measures in relation to the proposed development:

- Any excavation of lakebed sediment associated with the development should be subject to licensed archaeological monitoring by an experienced underwater archaeologist.
- Consideration should be given to devising a strategy for the management and preservation of the underwater cultural heritage of Inis Cealtra.

1 Introduction

1.1 General

Mizen Archaeology is engaged by *McCullough Mulvin Architects* on behalf of *Clare County Council* to undertake an Underwater Archaeological Impact Assessment (UAIA) of the proposed improved landing facilities at Inis Cealtra (Holy Island), Co. Clare. The assessment includes a desktop study, a geophysical survey, and a dive survey. The following report relays the results of this assessment and provides recommended mitigation measures to avoid or limit potential impacts on the archaeological heritage.

1.2 Conventions, Legislations, and Guidelines

The assessment was undertaken with due regard to the following national and international protective conventions, guidelines, and legislation:

- Historic and Archaeological Heritage and Miscellaneous Provisions Act 2023
- National Monument Act, 1930, amended 1954, 1987, 1994, and 2004
- Heritage Act, 1995
- National Cultural Institutions Act, 1997
- The Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous) Provisions Act, 1999
- *Frameworks and Principles for the Protection of the Archaeological Heritage*, 1999, Department of Arts, Heritage, Gaeltacht and the Islands
- Local Government (Planning and Development) Act, 2000
- European Convention on the Protection of the Archaeological Heritage (the 'Valletta Convention') ratified by Ireland in 1997
- Council of Europe Convention on the Protection of Architectural Heritage of Europe (the 'Grenada Convention') ratified by Ireland in 1997
- International Council on Monuments and Sites (ICOMOS), advisory body to UNESCO concerning protection of sites and recommendation of World Heritage sites ratified by Ireland in 1992

2 Receiving Environment

2.1 Location

Inis Cealtra or Holy Island, is a small, roughly 700m long island off the west shore of Lough Derg in Co. Clare (Figure 1). This lake is the third largest lake in Ireland and the second largest in the Republic of Ireland. It borders counties Clare, Galway, and Tipperary. Lough Derg is located along the River Shannon and is 39km long and 1–13km wide with a maximum depth of up to 36m (britannica.com). To the west of Inis Cealtra within Lough Derg is Scarriff Bay, where the Scarriff River joins the Shannon in the Lough.

The proposed development is located at the site of the existing landing on the northwest shore of Inis Cealtra.

2.2 Geology, Hydrology, and Soils

Lough Derg is the southernmost lake along the River Shannon. At its southern end, close to where the lake empties into the Shannon, are the falls of Doonass, the largest fall of the river. The lake is primarily gently sloping. Inis Cealtra is a lowlying, fertile, green island with areas of hydrophilious tall herbs, scrub, woodland of oak, ash, and hazel, and wet grasslands. The island is in an area of sandstone glacial till bedrock geology. Gleys make up 75% of the soil in the area, while peaty gleys compose 25% (National Soil Survey 1980).

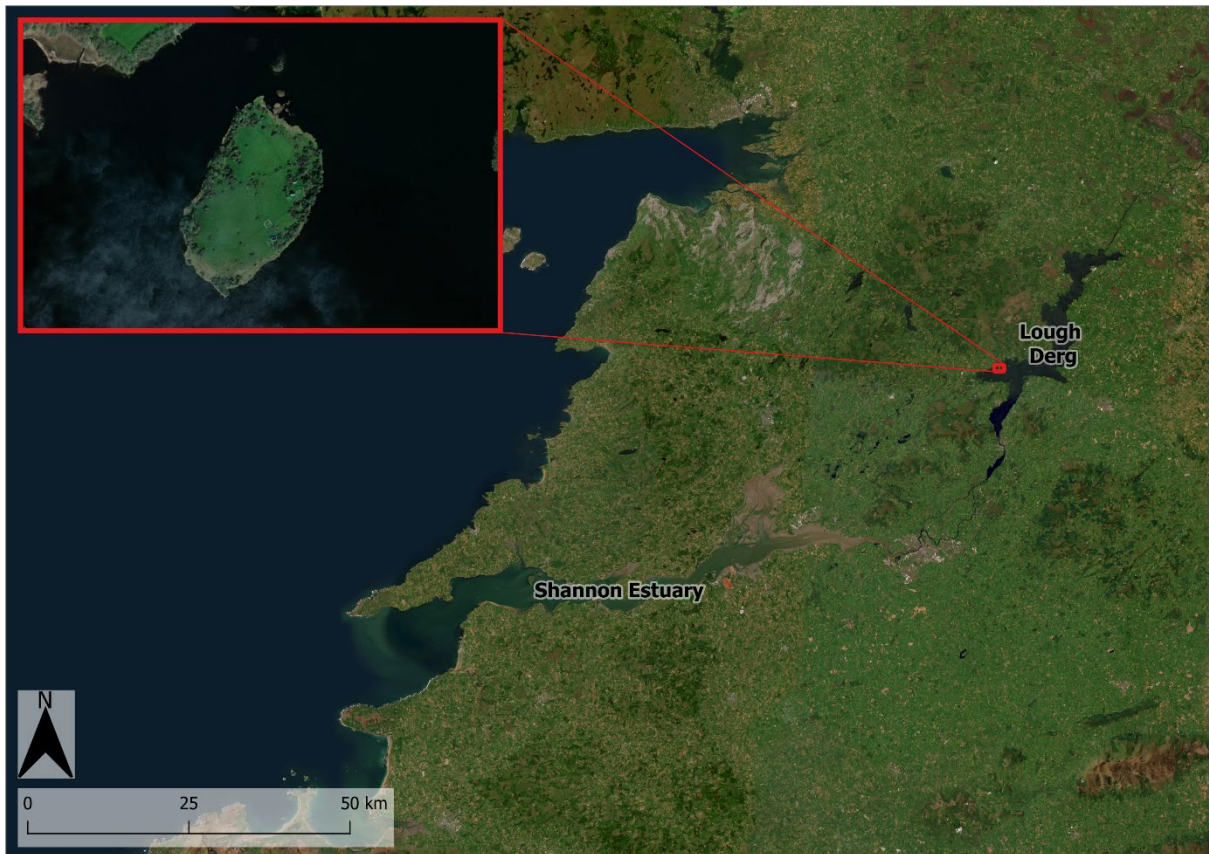


Figure 1: Location of Inis Cealtra within Lough Derg, along the River Shannon.

3 Scope of Works

The purpose of this project is to improve access to Inis Cealtra through either the upgrade of the existing pier or the construction of a new pier elsewhere. The current landing point is located on the northwest of the island (geophysical survey area No.3). Upgrading this structure would include removal and/or burial of a large part of the existing structure in order to raise the deck level and add breakwater features. A previously proposed location for a new pier was located on the northern shore and the currently proposed new landing point would be located at the northeast (geophysical survey area No. 1). Other areas which may be utilised include locations on the eastern shore (geophysical survey area No. 2) and the southern shore (geophysical survey area No. 4).

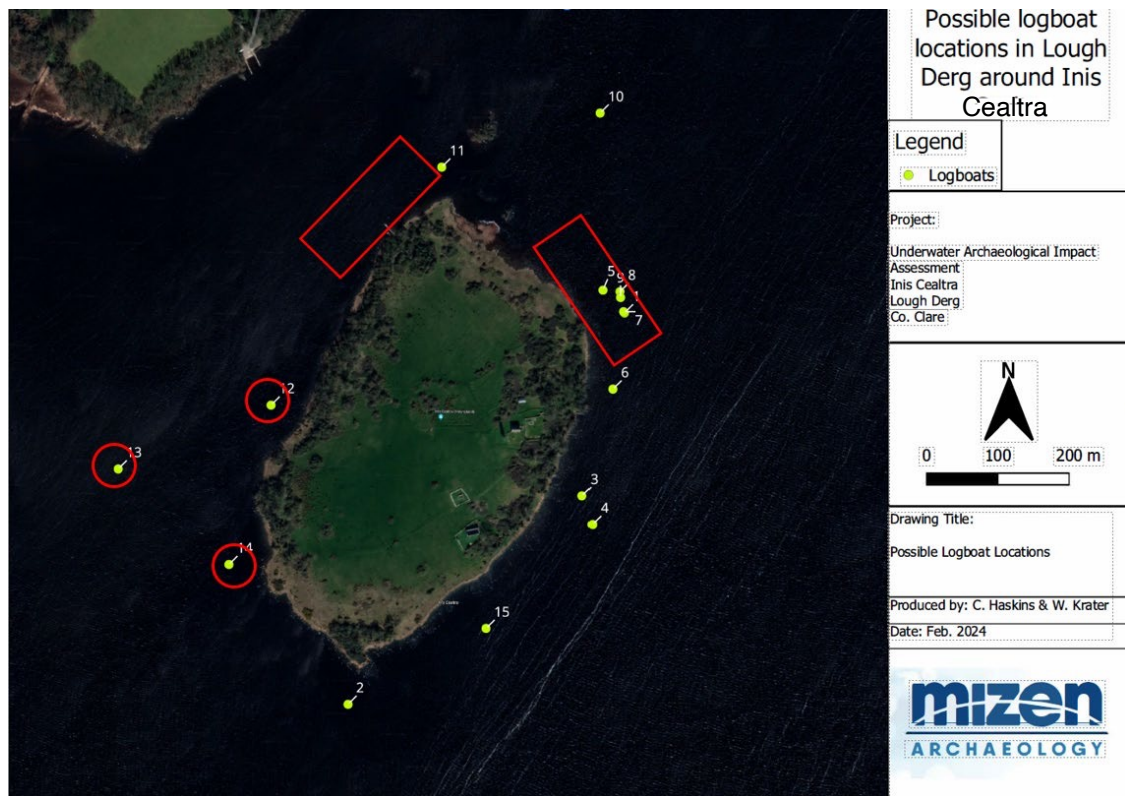


Figure 2: Two areas selected for dive survey each measuring 100 x 200m, as well as three other geophysical anomalies.

4 Methodology

4.1 Desktop Study

A detailed desktop study was undertaken to ensure all available literature and background information was considered to inform the underwater archaeological potential of the area under investigation. The following sources were consulted as part of the desktop survey:

- The Record of Monuments and Places (RMP) compiled by the Archaeological Survey of Ireland comprises lists, classifications of monuments and maps of all recorded monuments with known locations and zones of archaeological significance. The monument records are accessible online from the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage at www.archaeology.ie. These were used to establish the wider archaeological context of the site.
- Ordnance Survey of Ireland (OSI) historic and contemporary maps were examined to measure the changing landscape.

- The Register of Protected Structures (RPS) is a list of all protected buildings in a given area, as designated by the Local Authority. This may be due to a structure's architectural, historical, archaeological, artistic, cultural, social, scientific, technical, or industrial importance.
- The Excavations Bulletin online database, known as the Database of Irish Excavation Reports (www.excavation.ie) was consulted to review archaeological investigations done previously in the area.
- The Wreck Inventory of Ireland Database (WIID) and the Wreck Viewer include a broad range of cartographic, archaeological, and documentary sources concerning wreck data. Each entry in the inventory gives information on the ship's name, type of vessel, port of origin, owner's name, cargo, date of loss, and other relevant information where available. While the WIID contains information on approximately 18,000 shipwreck records (both those with known and unknown locations), the Wreck Viewer contains the same information for those wrecks but only those with known locations.
- National Museum of Ireland Topographical Files hold details of any artefactual material recovered in Ireland from the 18th century to the present. These are categorised according to County and Townland.
- Cartography: Several historic maps and charts were examined (see references below for a full list). These maps provide insight into the changes to the coastline over time along with changes in structure locations and navigational routes that may inform ship traffic and ship losses.
- Aerial Photography: A variety of low and high-altitude aerial photography was examined (see references below for a full list).
- Documentary sources: Several historical and archaeological sources were examined (see references below for a full list).

4.2 Geophysical Survey

A multibeam, side scan sonar (Edgetech 4125P) and magnetometry (Marine Magnetics SeaSPY) survey of the perimeter of the island extending 100m from the shoreline was undertaken. Given the shallow nature of the lake and the rocky shoreline it was not be possible to cover 100% of the survey area. Equipment was mounted on the vessel (as opposed to the standard towing method) to maximise coverage. Line spacings of 30m was used. *Mizen Archaeology* worked with *Hydromaster* to ensure that the geophysics survey complied with the unpublished guidelines for the undertaking of maritime geophysics provided by the Underwater Archaeology Unit (UAU) of the National Monuments Service.

Mizen Archaeology then examined the results of the geophysical survey in detail, and submitted a report on the findings to the UAU..

4.3 Dive Survey

Based on the results of the geophysical survey two 100m x 200m areas (Area 1 and Area 3), and three additional potential logboats to the southwest of the island were selected for further archaeological investigation including dive survey and metal detection surveys. Metal detection using a hand-held metal detection device was undertaken in tandem with the visual survey. The metal detector survey was undertaken using a Minelab Excalibur II metal detection device. The discrimination settings on the metal detector was set to 'pinpoint' to enable the detection of all metals. Each 3m-wide transect was subjected to a metal detection survey thereby ensuring 100% coverage. A five-person dive team carried out the underwater archaeological assessment.

A five-person dive team carried out the dive survey. All of the divers possessed HSA parts III and IV diving licences and HSA Medical Certificates. Diving operations complied with SI No 254 of 2018 Safety, Health and Welfare at Work (Diving) Regulations.

Diving operations were carried out using commercial SCUBA equipment (from a rib. Features or objects of archaeological significance were recorded, including a description, photographic record and GPS position. A GoPro camera with underwater housing was utilised for recording. The survey also recorded a number of aspects relating to the general setting of the site, including depth, flow direction, visibility and bottom type.

5 Results

5.1 Desktop Study

5.1.1 Archaeological and Cultural Background

Early Prehistory

Until quite recently, the earliest archaeological evidence of human habitation in Ireland dated to the Mesolithic (c. 8000–4000 BC) with the earliest site of Mount Sandel, Co. Derry dating to c. 8000 BC (Woodman *et al.* 1999, 131–51). A recent study by Dowd and Carden, however, have identified evidence of man-made cut marks on a bear patella from Gwendoline Cave, Co. Clare. The bone has been dated to c. 10,500 BC during the Palaeolithic period and may push back the date of Irish colonisation some c. 2500 years (Dowd and Carden 2016).

Many of the earliest Mesolithic settlement sites in Ireland have been identified along freshwater, including the earliest dated site of Mount Sandel (Waddell 1998, 4–23; Woodman 1999, 131–51). During this time, the upper reaches of the Shannon, from the estuarine limits to its freshwater courses, would have comprised wetlands, mudflats, salt-marshes, reed-swamps, fens and bog, giving way into scrubby, wet cover of carr woodland in the interior. At that time too, human presence would have been utilising this landscape for fishing and wildfowling along its channels and creeks, as well as a plethora of seasonally-gathered fruits and edible roots and plants (O’Sullivan 2001, 1-2).

Prehistoric burials have also revealed evidence from this period, at a site in Hermitage in Co. Limerick, on the banks of the Shannon. Dating to 9,500 years ago, it remains the earliest evidence discovered to date for a graveyard in Ireland. Along with the identification of several cremated individuals, a remarkable collection of stone axes was recovered, numbering 12 in total, as well as worked chert and flint. Consideration of the location of the cemetery is interpreted as associated with possible groups of individuals using the areas to who were able to control the fording point there, exploit the resources in the river, using it as a strategic trading location, as well as the use of the river itself as a means of transport (Collins and Coyne 2003, 26–7; 2006, 21).

The Shannon was the primary means for transport and trade from the earliest of times, and discoveries of the types of craft being used at the time provides evidence for this. From the earliest periods, logboats were the craft of choice, hewn out of the felled tree and shaped to fashion a riverine and estuarine vessel. An example from the Mesolithic period came from the mudflats of the Shannon, at Carrigdirty Rock in Co. Limerick (O’Sullivan 1996; 2001, 71–2) while others from later periods have also been discovered within the Shannon River and its catchment.

The first people to settle and farm the area date to the Neolithic Period some 6,500 years ago. These first farmers, cleared space in the forests, built houses, made pottery and shaped the land; they fished and migrated along the Shannon also using wooden, dugout canoes or similar wooden craft. While evidence of early prehistoric activity in the southwest of Ireland, has increased over the years, Neolithic evidence remains scarce (O’Sullivan 2001, 87). Intertidal studies of the Shannon Estuary have identified some evidence of human activity in the area at Meelick Rocks and Carrigdirty Rock. More than 100 polished stone axes and other stone tools have been recovered from the River Shannon between Killaloe, Co. Clare and Ballina, Co. Tipperary, just south of the southern mouth of Lough Derg.

Late Prehistory

The Bronze Age (c. 2400–500 BC) saw the use of metal in Ireland for the first time along with shifts in ritual monuments. Evidence for this period within the River Shannon is manifold. As some 358km in length, the Shannon has been the focus of travel, battles, votive offerings, etc. through time and these

activities are manifest in the artefactual material discovered from the river. Much of the material was identified during 19th and early-20th century dredging works as part of drainage schemes. Bronze Age artefacts recovered include weaponry (accounting for some 70% of finds), e.g. bronze and copper swords, axes, along with metal objects such as chisels, gouges and sickles. Lithic material was also recovered at Killaloe, Co. Clare, close to the southern mouth of Lough Derg, including 900 artefacts (Bourke 1996, 9–10). The activity of the region centred around more inland sites such as hillforts like the one at Formoyle Beg c. 16.5km southwest of Inis Cealtra. Again, intertidal studies of the Shannon Estuary have identified Bronze Age evidence at Carrigdirty Rock and Coonagh Point, east-southeast of the site under investigation (O’Sullivan 2004, 93–4).

The Irish Iron Age (c. 500 BC–AD 400) can be a difficult period to see in the archaeological record because it is generally aceramic, had less diagnostic monumental structures overall, and the defining metalwork is often too corroded to be identified to a specific period (Waddell 1998, 3). A few finds from the Shannon near to Lough Derg, however, have dated to the Iron Age including: a sword, two chapes, and a spearhead found at Keeloge, Co. Galway c. 13km northeast of the northern mouth of the lake; two swords and a spearhead found at Killaloe, Co. Clare, just south of the southern mouth of the lake; a chape found at Cullenagh, Co. Tipperary across from Killaloe; and a spearhead from Ballyvally, Co. Clare located on the southern mouth of the lake (CRDS 2006).

Medieval Period

The Early Medieval period (c. AD 400-1200) saw the influence of Christianity and the first use of the written word in Ireland. Documentary sources about Inis Cealtra from the early part of this period are scarce and most of what we know comes from annals and hagiographies. Inis Cealtra was reputedly founded in the 6th century by an Irish saint, though three saints are attributed to the island: St Mac Reithe/ Mac Creiche, St Colum of Terryglass, St Caimín (Ó Riain 2011). Before Killaloe became a centre of power in the region in the 10th century, Inis Cealtra and the ecclesiastical site at Tuamgraney, were the two most prominent settlements in east Clare (Solearth Architecture 2017).

The Vikings first sailed to Inis Cealtra in 836 when they burned much of the church, causing great damage. The Vikings returned in 922 when it is said they threw the reliquaries from the church into the lake (Todd 1867, 38). A Viking Age sword was found within Lough Derg in 1988 near Curraghmore, Co. Tipperary (NMI 1988:226).

During most of the Early Medieval, the area including Inis Cealtra was controlled by the Dál Cais. At the height of its power in the south of Ireland under the leadership of Brian Boru (reigning 976–1014),

the Dál Cais held their royal residence and ecclesiastical centres at Kincora, Killaloe, c. 12km south of Inis Cealtra along the Shannon. At this time, Brian made his brother Marcán the ‘coarb of Colum,’ calling direct ties to one of the possible founding saints (Solearth Architecture 2017).

In the 12th century, the leader of the time, Muichertach Uí Briain supported ecclesiastical reform following the pattern of the pan-European Gregorian Reforms (O’Leary 2015). After Muichertach’s death in 1119, the Uí Briain branch of the Dál Cais narrowed to include only the kingdom of Thomond, roughly the territory of modern day Clare. Their stronghold remained in the diocese of Killaloe. The church on the island began seeing a decline by the end of the 12th century, linked with the reformation ideas of the time. Inis Cealtra was part of the kingdom of Cét Ua mBlait into the Late medieval period (MacCotter 2008).

During the Late Medieval, monastic activity was still active on the island. Stone and metalworking was also active at the time. (Solearth Architecture 2017). The Late Medieval also saw the beginnings of pilgrimage which saw a rise in the Post Medieval following the disillusionment of the church.

Post Medieval and Early Modern

By the 17th century, all of the church structures on the island appear to have been in ruins. While the monastery was no longer active, there was a rise in pilgrimage at the time. *The Journal of Thomas Dineley* from 1681 notes the walking of stations on Inis Cealtra indicating that, once a year, pilgrims travel to the island in order to walk between the stations seven times while barefoot as an act of penance for their sins (Shirley 1867). Dineley also mentioned there being seven churches on the island, a figure repeated through many sources down to the 19th century with Lewis calling the site, the ‘Island of Seven Churches.’ Though there are only six churches on the site, the seventh structure considered was likely the 18th/19th century house. The additional building was likely counted for numerological reasons.

5.1.2 Place Names and Townlands

Ireland is known for its defining place names cities and towns to villages, roads, fields, bays, inlets, streams, and even rocks. Townlands in particular may hold important historical information. These areas are the smallest unit of official land division in Ireland and are thought to preserve some pre-Anglo Norman Conquest territorial boundaries and names. The Irish roots of these names may refer to natural or cultural features of the landscape. The layout and nomenclature of the townlands were recorded and standardised by the Ordnance Survey in the 19th century. *Logainm* holds an online

database of Irish placenames, their meaning, and related historical references. Other sources may also be used to track place names such as oral traditions, historic sources (e.g. 19th century or earlier charts), and documentary sources (e.g. the School's Folklore Collections).

Table 1: Place Names within the study area in English and Irish with translations.

English	Irish	Translation
Illaunaskirtaun	<i>Oileán na Sceartan</i>	'Island of the tick'
Inishcaltra (Holy island)	<i>Inis Cealtra</i>	'The name probably comes from Inis, meaning Island and Cealtair in the old Irish, meaning a Church. Dr P.W. Joyce, author of a book on place-names, suggests that it means "The Island of Celtchair."' (Clare County Library)
Leitrim (Barony)	<i>Liatroim</i>	<i>Liath Droim</i> : 'Grey ridge'
Lough Derg	<i>Loch Deirgeirt</i>	'Lake of redness'
Malt Island	<i>Oileán na Braiche</i>	'Island of the malt-house'
Red Island	<i>An tOileán Rua</i>	'Red island'
Young's Island	<i>Oileán na nÓg</i>	'Island of the young'

It has been suggested that Lough Derg, 'Lake of redness,' may have been named for the red algae found in its waters (logainm.ie). Inis Cealtra was likely named for the well-known ecclesiastical sites on the island, a name which perhaps dates back to as early as 548 AD (O'Donovan 1856). The nearby Malt Island may be so named for whiskey distilling on the small island as with a Malt House Field in Mullagh, Co. Clare recorded in the School's Folklore Collections (Vol 0624, p. 071). The nearby Red Island may be named after the red lake in which it is located. It is unclear where the name Illaunaskirtaun derives from, perhaps from ticks on island or from its small size. Likewise, it is unclear where the name for Young's Island comes from, though its Irish name is closely related to the mythological Tír na nÓg. The barony in which the island is located, Leitrim, is named after a feature of the natural landscape.

5.1.3 Cartographic Information

The Down Survey of Ireland (1656–8) indicates the island of 'Enishcaltra' in Tullagh Barony of County Clare (Figure 3). No prominent features are illustrated on the remaining county map of the period, but a large church site is indicated at Carrowmore to the north. The Barony of Leitrim in which Inis Cealtra is located according to modern boundaries is shown as part of County Galway at this time. The northern section of the land marked as 'Letrim Barony' remains part of the County Galway today.



Figure 3: Down Survey map of County Clare (1656–8) showing 'Enishcaltra' in the barony of Tullagh.

Pelham's *The County of Clare* (1787) and Larkin's *Map of the County of Galway* (1819) both show the cluster of structures on the island including a round tower (CL029-009010) and several possible church buildings (possibly CL029-009003, CL029-009006, CL029-009008, CL029-009011, or CL029-009015). The earlier map does not accurately cite the location of these structures, instead stylistically representing the structures spread across the island. The later map, however, appropriately shows the cluster of structures along the eastern coast. Larkin's map labels the structures as 'Ch[urch] and Round Tower.'



Figure 4: Pelham's The County of Clare (1787) illustrating structures on 'Inishcalto or Holy Island.'



Figure 5: Larkin's Map of the County of Galway (1819) illustrating structures on the island in the correct area.

The First Edition 6-inch Ordnance Survey map (1841) shows no infrastructure along the shoreline of Inis Cealtra (Figure 6). It does label numerous structures on the island itself, however. This includes four grave yards (CL029-009004, CL029-009007, CL029-009009, CL029-009030), 'St Michael's Church & Garden' (CL029-009006), 'St Mary's Church' (CL029-009008), 'Baptism Church' (CL029-009015), 'St Caimin's Church' (CL029-009011), 'Lady Well' (CL029-009023), a confessional (CL029-009017), and a 'Round Tower or Clogans' (CL029-009010). A path is also indicated leading from the northernmost point of the island towards these features, perhaps indicating an early landing point at the section of coastline. The shoreline is shown as shingle beach with a single, small, unnamed island just off the northern coast.

The Second Edition 25-inch Ordnance Survey map (1895, 1902) still shows no evidence of coastal infrastructure (Figure 7). The same structures are labelled as on the first edition map along with three 'stones' (two of these are possibly related to bullaun stones CL029-009024 and CL029-009028 or CL029-009029). The additional description of 'in ruins' is added to each of the structures. The shoreline is again shown as shingle beach with some rough pasture and areas of trees. Marshland is illustrated between Inis Cealtra and Illaunakirtaun.

The Final Edition 6-inch Ordnance Survey map (1907, 1920) shows the first coastal infrastructure on the island of a 'Landing Stage' (CL029-009026) on the eastern shoreline directly east of the confessional structure (CL029-009017) (Figure 8). The same monuments depicted on the earlier maps are still shown, though some are labelled in different locations such as 'Baptism Church' (CL029-009006) and 'St Michael's Church & Garden' (CL029-009003). One of the stones labelled in the second edition is here labelled a bullaun (CL029-009024), though none of the other stones are indicated on this map. Three other bullauns (CL029-009019, CL029-009020, CL029-009025) are labelled along with an additional stone in the south (now marked as penitential station CL029-009022). Other additional sites labelled on this map include the remains of a cross (CL029-009016), a station (CL029-009018), the base of a cross (CL029-009014), and 'Teampall na bhfear ngonta' (CL029-009015). The path from the monuments to the north is no longer shown. The shoreline is again depicted as shingly beach with rock outcropping illustrated along with teres along the coast. Marsh is again depicted between Inis Cealtra and Illaunaskirtaun.

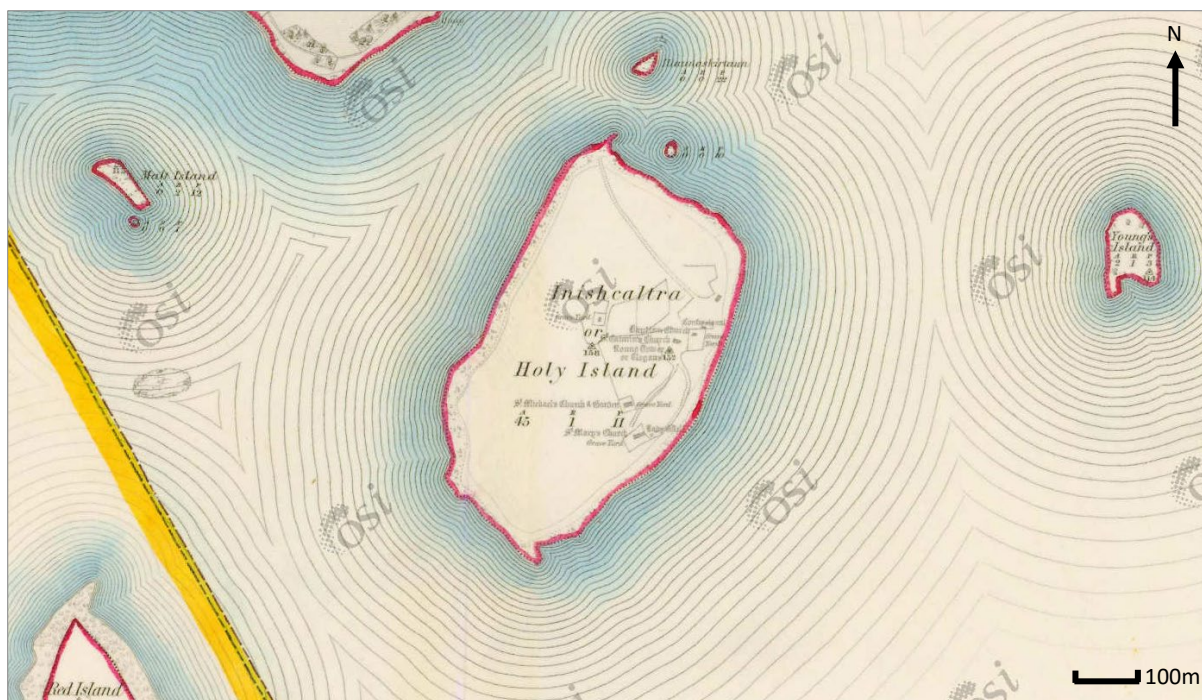


Figure 6: First Edition 6-inch OS map (1841) of Inis Cealtra.

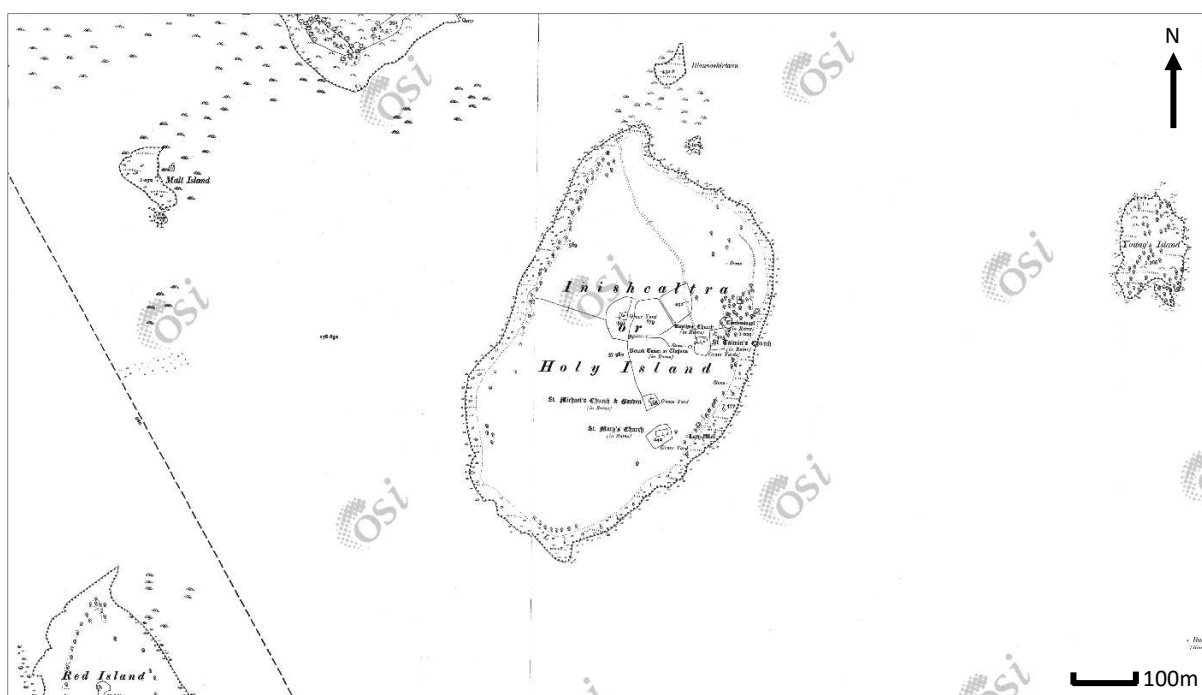


Figure 7: Second Edition 25-inch OS map (1895–1902) of Inis Cealtra.

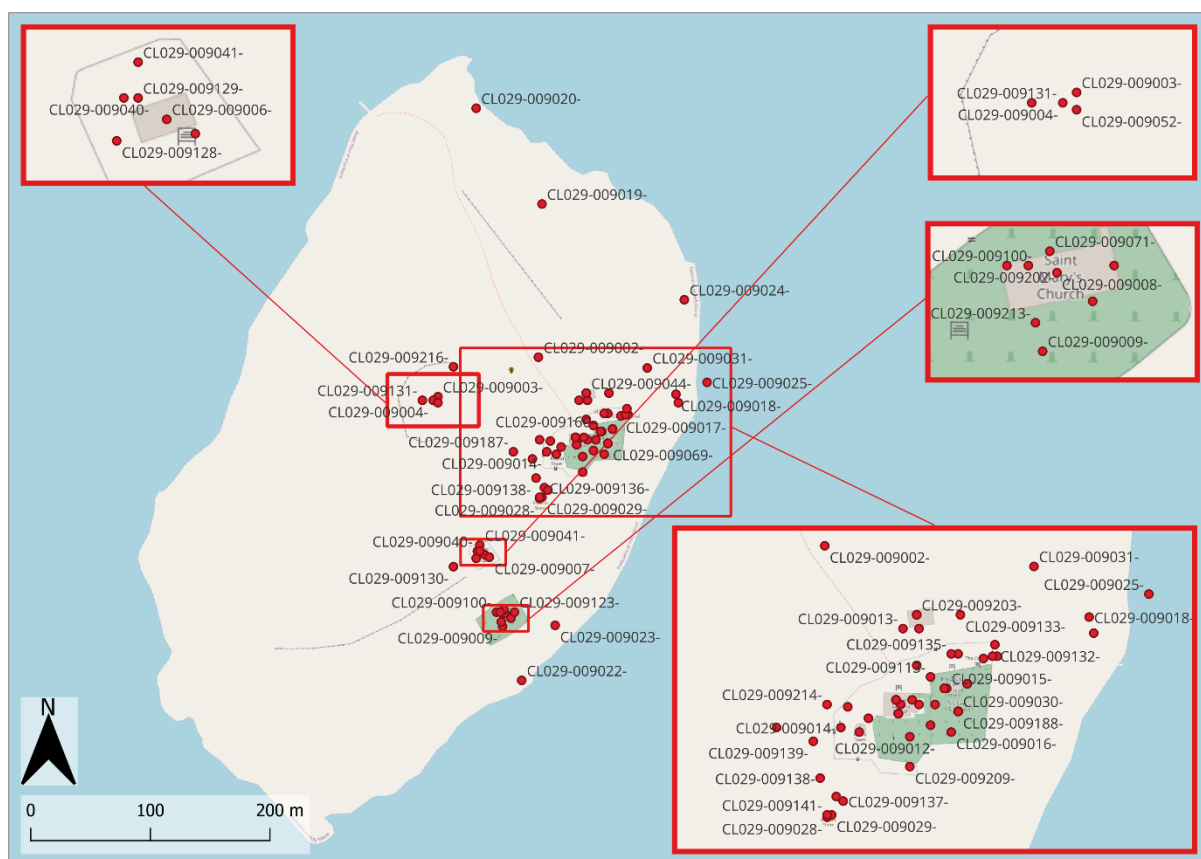


Figure 9: Recorded monuments on the Site and Monuments Record for Inis Cealtra.

5.1.5 Wreck Inventory

The National Monuments Service (NMS), Department of Housing, Local Government and Heritage has compiled a database of shipwrecks from around the coast of Ireland – the Wreck Inventory of Ireland Database (WIID). The inventory lists some 18,000 wrecks comprising both known and unknown losses, and with both known and uncharted locations, from within Ireland’s territorial water and beyond out to the edge of Ireland’s Continental Shelf. Wrecks with known locations, nearly 4,000 of them, are mapped and can be viewed on the NMS’ online Wreck Viewer.

All wrecks in Ireland’s territorial waters and Contiguous Zone (up to 24 nm limit offshore) are protected under the 100-year rule under the National Monuments Amendment Act 1987-2014.

The NMS’ Wreck Inventory Database contains four wrecks recorded within Lough Derg (Table 2). Only the wreck W11166 has an exact known location, on the northern end of the lake. The other three wrecks have not been located. One of these (W12590) is listed as lost off Dromineer, a small harbour directly east of Inis Cealtra, and another (W14347) is listed as lost between Mountshannon, the town closest to the island, and Dromineer. There have also been several log boats recorded around the

island that are not yet included within the Wreck Inventory. Four boats were reported in 2011 by local divers under the licence 11D0033 along with one other potential site. Three of these have been confirmed as log boats.

Table 2: Wrecks listed on the WIID as lost in Lough Derg.

Wreck No.	Wreck Name	Classification	Date of Loss	Place of Loss
W11166	unknown	Logboat	unknown	53.05535, -8.24568 Lough Derg, off Gortmore Point
W12590	<i>Hebe</i>	Cutter	01/12/1900	Lough Derg, off Dromenier
W14347	<i>Venture (MV)</i>	Motor Boat	29/05/1939	Lough Derg, between Mountshannon and Dromenier
W14611	<i>Malgre Tout</i>	Cutter	09/07/1913	Lough Derg

5.1.6 Topographical Files

The Topographical Files of the National Museum of Ireland (NMI) holds details of any artefactual material recovered from the 18th century to modern day. No finds are listed from near Inis Cealtra, though a dug out canoe was reported from Red Island to the southwest (NMI 1929:1370).

5.1.7 Previous Archaeological Investigations

Extensive excavations took place on Inis Cealtra under the direction of Liam de Paor in 1970–6 and 1980–4 (Licence No. E000180) (Appendix 9.2). The excavations focused on standing structures including Baptism Church (CL029-009006), Lady Well (CL029-009023), ‘the cottage’ (CL029-009031), St Michael’s Church (CL029-009003), the ‘confessional’ (CL029-009017), a slope between St Michael’s and the confessional, and St Caimin’s Church (CL029-009011) and the Roundtower (CL029-009010) (excavations.ie). A detailed discussion of these excavations can be found in ‘Inis Cealtra: Appendix 2: Detailed Support Material’ prepared by Solearth Architecture for the project (Solearth Architecture 2017). Further post excavation work is also underway (O’Sullivan and Seaver 2015). All of the excavated remains date to the Early Medieval period and later, attesting to an early foundation of the site and a long history of use since.

An underwater investigation took place at the site in 2021 to investigate for this project (Licence No. 21D0019, 21R0025). This included a dive survey off the north shore, a drone survey of the northern shoreline, and a walkover inspection and metal detection survey of this shoreline. This revealed a timber post, an *ex situ* timber post, and investigated previously identified features to positively identify one as a log boat and the other as a tree trunk (Brady 2021).

5.2 Geophysical Survey

Hydromaster conducted an archaeo-geophysical survey encompassing a 100m corridor surrounding Inis Cealtra in January 2024. The survey utilised multibeam (MBES), magnetometer and sidescan sonar (SSS) equipment.

The MBES data produced 21 acoustic targets while the SSS and Magnetometry data identified 80 and 11 targets respectively. In total 15 of the targets were interpreted as possible logboats (targets AT1-SSS1, AT4-SSS40, AT12-SSS52, AT17, AT20-SSS48, SSS54, SSS63, SSS64, SSS65, SSS68, SSS71, SSS75, SSS76, SSS77, SSS78).

5.3 Dive Survey

Based on the results of the geophysical survey two 100m x 200m areas (Area 1 and Area 3), and three additional potential logboats to the southwest of the island were selected for further archaeological investigation including dive survey and metal detection surveys.

Area 1 is located to the northeast of the island. Much of the area overlaps with a previous survey carried out by ADCO in 2021.

Area 2 is located to the northwest of the island and encompasses the existing landing facility at Inis Cealtra. It has been selected as the preferred location for the development of improved land facilities.

5.3.1 Area 1

The geophysical survey identified seven anomalies of potential archaeological significance (possible logboats) within area 1. The dive survey achieved 100% coverage of the area using 3m wide diving transects. Particular attention was given to the areas which produced geophysical anomalies.

Water depth was recorded as 0.4m in the western extremity of the survey area close to the shoreline and increased to 4m at the eastern limit of the survey. The lakebed is composed of rock outcropping and boulders at the western limit of the survey area which peters out towards the middle of the survey area. The eastern side of the survey area comprises soft silt. Vegetation was heaviest on the shoreward side and mollusc shells were noticeable on hard surfaces across the entire survey area. The dive survey confirmed 3 definite and another probably logboat in Area 1. The metal detection produced a small amount of bottle tops and modern wire.

Logboat 1 ITM 569998, 685222

Logboat 1 was discovered by local divers in 2011 who described the vessel as: *....lying on top of a silt and rock surface. 5.08m length, 0.80m maximum width. Cross section is flat without edges, partially split longitudinally in two places along most of its length. There is a series of three small holes in a line across the width of the canoe approximately a metre from one end of the canoe. The three large holes are in a similar pattern 0.65m from the other end. Canoe is heavily colonised in zebra mussels.*

This is the basal remains logboat, which is partially exposed and colonised by molluscs. A modern string connects the western end of this logboat to logboat 2 which lies a few meters to the northwest.

Logboat 2 ITM 569997, 685223

This feature was identified in the 2011 survey as a possible vessel partially embedded in silt but was later discounted by ADCO as a natural tree trunk.

It measures c. 3.5m in length and is partially wedged under a bedrock outcrop. In the absence of excavation, it is difficult to definitively assess the object. However, it appears to have at least one surviving worked surface, and it interpreted as the eroded remains of a logboat lying on its side.

Logboat 3 ITM 569968, 685254

A logboat was identified at ITM 569968, 685254. It corresponds with the general location of a logboat discovered by local divers in 2011 who assigned the name 'Canoe 3'.

It is orientated E-W and is 6.4m in length, 0.7m in width and 4cm in thickness. The western half of the vessel is partially exposed but only the outline of the eastern half is visible. It appears to taper towards the western end, which is in a damaged broken state surviving for a width of 0.37m.

Aquatic weeds are well established on this site, growing vigorously in the sediment within the logboat. The presence of zebra mussels that grow attached to any hard surface suggest the continuity of the shape and presence of the rest of the logboat.

Logboat4 ITM 569953, 685267

The site has previously been exposed, possibly as a result of excavation. It was recorded by local divers in 2011 and grid pegs and string used during the survey are still in place. It was described as having a

deep U-shape in cross section and a significant carved detail situated near the gunwale towards one end of the boat (Lemasney and Moloney, 2011). An animal bone displaying evidence of butchery was recovered from the logboat during the 2011 survey.

Currently the logboat is almost entirely buried, and therefore it was not possible to record any construction details. Approximately 0.2m of the northwest end of the vessel is partially exposed. Elsewhere, only the uppermost 1cm of the vessel is visible. It was identifiable by the abundance of mollusc adhering to the exposed wood for a distance of 5.8m. The southeast end is completely buried. The surrounding lakebed is littered with mollusc and a significant amount of submerged vegetation was also noted.

Anomaly 6 ITM 569981.9, 685114.9

Anomaly 6 presented as an oblong object measuring 2.4m by 0.2m in the geophysical data and was initially interpreted as a possible logboat. The dive survey revealed no evidence of a logboat at this location. The lakebed at this location comprised soft sediment with clusters of boulders. Notably the boulders are oblong and straight-sided which accounts for the feature represented in the geophysical data.

Anomaly 8 ITM 569991.8, 685251.6

The anomaly was located in shallow water within an area of dense submerged vegetation which lessened towards the east. The lakebed comprised soft silt with occasional large outcrops of bedrock and boulders. There was no evidence of archaeological remains at this location. It is likely that the boulders or outcropping produced the anomaly in the geophysical data.

Anomaly 9 ITM 569992.6, 685243.3

Anomaly 9 is located in close proximity to Anomaly 8. Similarly, no evidence of archaeology was recorded at this location and it is suggested that the anomaly resulted from the presence of boulders on the lakebed.



Plate 1: View of Inis Cealtra taken from survey boat.



Plate 2: View of Logboat 1



Plate 3: View of Logboat 2



Plate 4: View of Logboat 3



Plate 5: View of outline of Logboat 4 buried in sediment.



Plate 6: View of Anomaly 6



Plate 7: View of Anomaly 8



Plate 8: View of Anomaly 9

5.3.2 Anomalies to the southwest of the island

Anomaly 12 ITM 569503.3, 685092.6

This anomaly was located within area of soft silt with occasional vegetation and angular stones. The anomaly appears to represent these naturally positioned stones.

Anomaly 13 ITM 569288.9, 685003.1

Anomaly 13 was located within area of silt with occasional molluscs visible. A minor scour was noted at this location which may account for the anomaly in the geophysical data.

Anomaly 14 (wooden plank) ITM 569444.3, 684869.1

This is a long narrow timber which is largely exposed on the lakebed. Although the timber has been worked, there is no definitive evidence to suggest it once formed part of a logboat. It has a flat upper worked face while the underside is rounded. Knots are visible at several points along its length. It measures 4.2m in length, 0.25m in width and 6cm in thickness.



Plate 9: View of Anomaly 12



Plate 10: View of Anomaly 13



Plate 11: View of Anomaly 14

5.3.3 Area 3

The northern eastern portion of the survey area consisted of an impenetrable reed and tall sedge swamp and therefore could not be inspected. Submerged vegetation persisted to a lesser extent in the northwestern extent. The lakebed in Area 3 is composed of fine silt with occasional inclusions of angular stones. Molluscs were noted throughout the survey. Very occasional modern debris, including polypropylene rope and plastic bottles were noted. The metal detection produced a small amount of aluminium cans and bottle tops.

Anomaly 11 ITM 569742.8, 685425.9

This geophysical anomaly was adjacent to an area of reeds close to the north western shoreline of the island. The surrounding lakebed consisted of soft silt intermixed with small angular stones. No evidence of archaeological significance was observed.

Upright stakes ITM 569686, 685406

Two stakes of equal dimensions measuring 0.15m in height and 0.06m in thickness set 10cm apart were identified in an upright position in the northern limits of Area 3. The surface of the wood is eroded and colonised by molluscs. There are no other features visible on the surrounding soft sediment. The nature/purpose of the objects is unknown.



Plate 12: View of Anomaly 11



Plate 13: View of uprights in Area 3.



Figure 10: Results of dive survey.

6 Potential Impacts

Having considered various alternatives Clare County Council selected the existing landing area on the northern shore of the island as the preferred location for the development of improved landing facilities. In the context of this assessment report, the preferred option is encompassed within Survey Area 3.

In general terms, it is anticipated that the proposed construction activities for the improvement of landing facilities at Inis Cealtra will involve some level of excavation/disturbance of lakebed sediments. No evidence of archaeological material was noted on the lakebed in close proximity to the proposed development. The closest definitive underwater cultural heritage site is Logboat 4 some 300m to the east.

Lough Derg has produced significant evidence of human activity including foraging, fishing, boating and settlement from at least the Neolithic Period onwards. The ecclesiastical site at Inis Cealtra was likely founded in the 6th century AD. The silty lakebed observed during the dive survey provides ideal anaerobic conditions necessary for the preservation of ancient organic remains such as wooden jetties, boats, fish traps, and fish weirs. Any construction activities carried out on or adjacent to the lakebed may result in direct negative impacts on previously unrecorded archaeological artefacts or features such as these.

Indirect negative impacts may arise during the operational phase with regard to inadvertent damage to recorded underwater heritage sites due to an increase in boating activities around the perimeter of the island. However, provided that mitigation measures are implemented, it is not predicted that there will be significant operational phase effects on the underwater cultural heritage resource.

7 Mitigation Measures

Any excavation of lakebed sediment associated with the development should be subject to licensed archaeological monitoring by an experienced underwater archaeologist. Should archaeological remains be identified during the course of archaeological monitoring, all works should cease in the area of archaeological interest pending a decision of the Planning Authority, in consultation with the Department of Housing, Local Government and Heritage, regarding appropriate mitigation which may include avoidance, testing or full archaeological excavation.

Consideration should be given to devising a strategy for the management and preservation of the underwater cultural heritage of Inis Cealtra. This should include an investigation of the remaining

unidentified anomalies, a monitoring programme for the confirmed logboats and an evaluation of the impact of submerged vegetation and mollusc growth (including invasive species) on the logboats.

Consideration should be given to fully exposing one of the well preserved logboats and undertaking a full photogrammetric survey to generate an accurate and detailed 3D model which would allow the wider public to engage with the underwater site without the need for diving. This survey would also allow for a better understanding of the boat building techniques and resources required to construct the vessels and how they came to rest at on the lakebed; all of which would help to place the archaeological site in its social, cultural and environmental context.

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9 Appendices

9.1 Sites and Monuments Record (archaeology.ie)

SMR No	Townland	Type	ITM	Description
CL029-009002-	Inishcaltra or Holy Island	Field system	569814E, 685129N	<p>This record was listed as 'Earthwork complex' in the RMP (1996). There are several subdivisions of the land around the monastic remains on the island of Inis Cealtra (Holy Island). Between St.Caimin's church (CL029-009011-) on the E side of the island and the D-shaped enclosure (CL029-009131-) centrally placed, there are a number of subrectangular areas defined by double banks or roadways. According to de Paor (2013, 45) rough drystone walls were erected to form small enclosures and these were linked by equally rough paved ways in a network which covered the monastic quadrant. These were essentially a layout for the performance of pilgrimage 'rounds' (although they also probably served for the formation of small tillage plots and paddocks). Pathways linking different sites for pilgrims began as early as the late 13th century but the main development was later continuing until the late 17th or possibly the 18th century. In the later phases a broad paved road (max. Wth 9m; int. H 0.2m; ext. H 1.5m) connected St. Caimin's Church (CL029-009011-) with St. Mary's (CL029-009008-). Another pathway (max. Wth 6.3m; H 0.15-0.8m) connects the northern tip of the island near one of the landing points with the main ecclesiastical complex. Excavation revealed that a bank-and-ditch system extending S to St. Brigid's church (CL029-009006-) from the central D-shaped enclosure (CL029-009131-) and the peripheral bank running into the S boundary of St Brigid's enclosure (max. Wth 2.7m; H 0.1-0.15m) belong to an early phase of activity on the island (ibid., 35). The feature extending S from St. Michael's to St. Brigid's has been radiocarbon dated to Cal AD 778-985 (UBA-27543). A late 8th to early 9th-century bronze pin was found in its primary fill. The secondary fill produced the radiocarbon dates confirming the chronology indicated by the pin (Seaver and O'Sullivan 2015, 12-13). Two separate features, a bank (max. Wth 5.1m; H 0.3-0.4m) and a fosse (max. Wth 5.1m; D 0.1-0.25m) extend W from the D-shaped enclosure forming a triangular area. There are traces of ridge and furrow cultivation throughout the island (Bing image http://binged.it/1LSeFWo; Accessed 8 July 2015). (Macalister 1916-17, 141-2) Iniscealtra is a national monument in state care, no. 5.</p>

CL029-009003-	Inishcaltra or Holy Island	Church	569730E, 685096N	St. Michael's church was situated towards the centre of Inis Cealtra on Lough Derg within a small children's burial ground (CL029-009004-) which is itself within a possible ringfort (CL029-009131-). The lower courses of a very small mortared stone structure (ext. dims. 2.8m x 2.7m) oriented WNW-ESE were excavated by de Paor in 1972-3. He found it to be without foundations but it was paved internally with flags. Macalister had described a building of roughly coursed flat stones with a doorway at W (Wth 0.48m). A small fragment of moulded stone which may have been associated was found lying inside the building in 1916. De Paor established that this building was late within the chronology of activity in this area which spanned about AD 1500 to the late 19th century and was likely to have been constructed while the surrounding enclosure was in use for infant burial. This was one of the stations during pilgrimages and a large sandstone block (CL029-009052-) within the burial ground was used as a penitential station during the rounds. The area is much overgrown and only the penitential station is evident. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916, 117-18; de Paor 2013, 36-7)
CL029-009004-	Inishcaltra or Holy Island	Graveyard	569726E, 685093N	Situated towards the centre of Inis Cealtra (Holy Island) within a possible ringfort (CL029-009131-). A roughly square enclosure (max. dim. c. 15m) excavated in 1972-3. Prior to excavation it was defined by a low stony bank. Construction was found to have been in two phases, the first consisting of an earthen bank and fosse and later an unmortared stone wall. Some remains of stone paving were found running along the inside of the wall. The enclosure had been used as a burial ground, exclusively for infants, almost all new-born. A handful of quartz pebbles and a long stone pebble were deposited in most of the graves. Macalister noted an entrance (Wth 0.81m) in the middle of the S side with two jambstones on the E side and one on the W. A small cell or church (CL029-009003-) lay within the enclosure. A large sandstone block (CL029-009052-) within the burial ground was used as a penitential station during pilgrimage rounds. The area is much overgrown and only the penitential stations is evident. (Macalister 1916, 117-18; de Paor 1973; de Paor 1997; de Paor 2013, 36-7)
CL029-009006-	Inishcaltra or Holy Island	Church	569769E, 684964N	Situated within a subrectangular enclosure (CL029-009007-) c. 90m SW of the Round Tower (CL029-009010-) on Inis Cealtra (Holy Island) in Lough Derg. Named 'St Michael's Church and Garden' on the 1840 OS 6-inch map, 'Baptism Church' on the 1920 OS 6-inch map and called 'St Brigid's church' by Macalister (1916). A small, ruined, single-celled church (ext. dims. 8.5m by 5m) with a Romanesque doorway (Wth 0.7m; H 1.85m) at W. There are two deeply

				<p>splayed windows one in the E wall and one on the S wall near the altar. The E window is widely splayed (Wth 0.72m; H 0.7m; sill H 1.2m) and has been robbed out. The window in the S wall also has a wide interior splay (Wth 0.92m; surviving H 0.8m; sill H 0.95m) and the window itself was 0.15m wide. Excavation took place here from 1970 to 1972 revealing much collapsed masonry. The roof was slated and there was evidence that slates, brought from elsewhere, were trimmed in situ. The church was built about the middle of the 12th century but was abandoned as a place of worship about the beginning of the 13th century. The interior of the church was used for burial, almost certainly in the 13th century and perhaps later, with at least twenty bodies being deposited, two of which were of women in childbirth. The burials were all extended, all but one lying E-W. The doorway and W gable had fallen by the early 19th century but these were rebuilt by the Board of Works in 1879-80 with some small irregularities. For a time in the 19th century the building was used to house animals. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 119-22; De Paor 1970; 1971; 2013, 28, 31-6)</p>
CL029-009007-	Inishcaltra or Holy Island	Graveyard	569773E, 684962N	<p>A subrectangular enclosure (21m E-W; 20m N-S) on a S-facing slope surrounding St. Brigid's church (CL029-009006-) and named 'Graveyard' on the 1920 OS 6-inch map. Defined by a roughly coursed, mortared wall (at W: int. H 0.66m; Wth 0.83m; ext. H 1m) with a round-headed entrance (Wth 0.73m; H 1.73m) midway along the S wall with a simple moulding inside. Before excavation in 1970-71 it was defined at W, N and E by an earthen bank with some stone. Excavation took place here from 1970 to 1972 and revealed that the enclosure had been repaired and rebuilt several times with a drystone wall forming the last in a series of enclosing features. Paving inside the wall was associated with the making of stations or rounds. No burials were found within the enclosure. A deep V-shaped fosse along the N sector and a broad shallow fosse at E were considered to be features of an early phase of activity on the island. A hazel sample from the fill of the enclosure fosse at N yielded radiocarbon dates of Cal AD 992-1150 (UBA-27540)(Seaver and O'Sullivan 2015, 12-13, 33). Fragments of two bone combs from the fill date to AD c. 1050-1125 (ibid., 13). The building of St. Mary's church (CL029-009008-) c. 30m to the S very early in the 13th century involved the construction of the mortared stone wall which now forms the S boundary of the enclosure. A copper-working furnace (CL029-009128-) was found within the enclosure just W of the doorway of St. Brigid's church and there was evidence of iron-working (CL029-009129-</p>

) within the enclosure immediately N of the church. Further metalworking evidence (CL019-009130-) was revealed outside the enclosure to the W. Iniscealtra is a national monument in state care, no. 5. (De Paor 1970; 1971; 2013, 28, 31-6)
CL029-009008-	Inishcaltra or Holy Island	Church	569786E, 684915N	Situated on a S-facing slope within a graveyard (CL029-009009-) some 43m S of St. Brigid's church (CL029-009006-) on Inis Cealtra in Lough Derg. St. Mary's is the largest (ext. dims. 18.57 by 8.72m) and most southerly church on the island, originally constructed in the late 12th/early 13th century but used as a medieval parish church and much reconstructed subsequently. It has a W doorway (Wth 1.07m; H 2m) with a slightly pointed arch and a simple external moulding of early 13th-century date. Two other later doorways, one in the S wall (Wth 1.42m; H 2.32m) 5.3m from the W gable and one in the N wall (Wth 1.12m; H 1.84m), are now blocked up. The N doorway is only visible externally. The church was not well lit. There were only two windows, a tall single lancet in the E end (Wth 0.23m, remaining H 1.2m with a deeply splayed embrasure) and another single round-headed lancet on the S wall to light the altar. This was also deeply splayed (int. H 2.5m; Wth 1.5m). There is an unusual offset in the S wall starting just W of the window and extending along the length of the church but not reaching the top of the wall. The wall may have been thickened at some stage by adding a new face to the inside. There are two aumbries, one in the S wall near the E corner and one in the N wall near the E end. The head of an ogee-headed window is mounted inside the upper portion of the blocked-up doorway on the S wall and the lower part of a window is placed on the ground beneath. It is not clear where these belonged originally. There is a buttress against the N wall externally with a water channel or slop-stone pierced through. An elaborately carved altar at the E end formed part of an O'Brien wall monument (CL029-009123-) the upper portion of which is mounted on the S wall. Four cross-slabs (CL029-009071-, CL029-009100-, CL029-009108-, CL029-009202-) are mounted on the walls in the interior. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916, 130-31; de Paor 2013, 28)
CL029-009009-	Inishcaltra or Holy Island	Graveyard	569784E, 684904N	Situated on a pronounced S-facing slope at the SE end of Inis Cealtra. A subrectangular graveyard (c. 37m NE-SW x 27m NW-SE) defined by a roughly coursed mortared wall fairly even in height all around (int. H 1.06m; T 0.6m; ext. H 1m) with an entrance gate (Wth 1.3m) on the N wall adjacent to the NW corner of the church and a style (Wth 0.2m) further NE along the N wall. St Mary's church (CL029-009008-) lies within this graveyard and the original

				perimeter wall extended as far as what is now the S wall of St Brigid's graveyard (CL029-009007-). The inscribed headstones are of 19th and 20th century date.
CL029-009010-	Inishcaltra or Holy Island	Round tower	569829E, 685048N	Situated on a low hill 12m SW of St. Caimin's church (CL029-009011-) on Inis Cealtra. A well-built round tower with a flat top. The stonework is well coursed with exceptionally large stones in the base. The wall is offset 0.1m at the base 0.3m above ground. Excavations in 1976 revealed this course to be 0.4m deep with a thin layer of small stones and natural rock below that (Barrow 1985, 61). The diameter at base is 4.58m and at the doorway at ENE it is 4.5m. The interior is dug out to 0.6m above the external offset. Large stones project from the wall corresponding to the large stones in the external wall. There is a rough offset for a floor 2m above the ground. The second floor is formed by a number of large corbels and flagstones projecting from the wall and higher up there are three more offsets. The door at ENE is round-headed (Wth 0.64m at base; H 1.6m to soffit; T 1.05m). The top of the door is cut out of three stones carried right through the wall and the sill, likewise, is a single slab. A large, finely dressed, angle-headed window faces N above the second floor level and three more square-headed windows face ENE, SSW and NW in ascending order. The excavation revealed careful preparation in advance of construction. A large oval disc of puddled clay studded with small boulders and stones was laid down, ringed by small drain-trenches. A short sequence of post-holes concentric with the tower at NW were interpreted as marking the end of a stairway which rose to the sill of the door. A number of burials were found between the round tower and St. Caimin's (CL029-009140-). Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 137-9; Barrow 1979, 61-3; De Paor 2013, 41-2)
CL029-009011-	Inishcaltra or Holy Island	Church	569847E, 685060N	On the E side of Inis Cealtra (Holy Island) and at the centre of the monastic complex, St Caimin's church is a building of several periods of construction. It was originally a single-celled building (int. dims. 9.22m E-W by 6.1m N-S) with corner antae, in roughly coursed, mortared stone, no doubt with a trabeate doorway (de Paor 2013, 27). The remaining more westerly window in the S wall (H 0.75m; Wth at base 0.4m; Wth at top 0.32m) is of the first period of building which is most probably of 10th century date. It has a flat lintel and inclined sides with an external reveal and the interior sill is built up in steps. There is also a round headed window with external moulding in the S wall closer to the chancel (H 0.7m; Wth at base 0.28m; Wth at top 0.27m). This also has a splayed embrasure but the sill is plunging

				<p>rather than stepped. A curious small triangular window formed of three stones occupies the W gable high above the door. While this may be original it is not paralleled at other early churches (Ó Carragáin 2010, 309). A Romanesque doorway was later made in the W wall; the present doorway of four orders was inserted during the excavations in the 1970's replacing a door with three orders built in 1879. A Romanesque chancel was inserted between the E antae. The chancel (int. dims. 4.4m x 3.8m), sometimes referred to as St. Colum's church, is neatly built with well squared stones and it is not bonded to the nave. Where the E wall of St. Caimin's was broken through a chancel arch was inserted with three orders facing the nave and two facing the chancel. Ornament was confined to the rounded piers which are adorned with capitals and there is a grotesque head on the keystone facing the nave. The side walls of the chancel are of ashlar masonry and there is one remaining round-headed window in the S wall (H 0.63m; Wth 0.15m) with an external rebate and internal splay. There may originally have been an E window. The altar as restored is a block of masonry with bowtell mouldings at the angles capped with floral capitals. Ó Carragáin (ibid., 197) notes that monumental altars of well-dressed stone are very rare with only three convincing examples published - this one and two others also in Clare (Dysert O'Dea and Rath). There is a small square aumbry on the S wall close to the chancel arch. A string course extends along the N and S sides of the chancel just below the roof level. At some stage a bell-cote was contrived in the E gable and the building was extensively restored by the Board of Works in 1879-80. The nave was reroofed in the 1990s by the OPW. A large number of crosses and cross-slabs are housed in the church. A graveyard (CL029-009012-) lies to the S and another graveyard, known as the 'saint's graveyard' (CL029-009030-) lies immediately to the E. A round tower (CL029-009010-) lies 11m to the SW. Excavation in this area in 1974 revealed some burials (CL029-009140-) outside the church to the W. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916, 122-30; De Paor 1974; 2013, 27-8)</p>
CL029-009012-	Inishcaltra or Holy Island	Graveyard	569851E, 685046N	<p>Situated on a gentle S-facing slope on the E side of Inis Cealtra S of St. Caimin's church (CL029-009011-). An irregularly shaped graveyard (c. 25m E-W; c. 27m N-S) defined by a low mortared wall (av. int. H 0.65m; Wth 0.4m; ext. H 1.1m) of roughly coursed rectangular blocks, cross-capped with rough slabs. There is an entrance gate (Wth 1.26m) at the SW corner of St. Caimin's church where it meets the graveyard wall. A small stile at W (Wth 0.28m) is splayed internally and externally. The E wall is shared with the 'Saint's graveyard'</p>

				(CL029-009030-). The headstones are mostly 20th century but a possible cross-inscribed stone (CL029-009195-) is erected at E just outside the entrance to the Saint's graveyard.
CL029-009013-	Inishcaltra or Holy Island	Bullaun stone	569848E, 685093N	Situated c. 30m N of St. Caimin's Church (CL019-009011-) on Inis Cealtra and obscured by wooden fencing. A small subcircular stone (L 0.6m; Wth 0.56m; H 0.3m), almost totally moss-covered with a circular basin (diam. 0.35m; D 0.18m) filled with clay. This bullaun may have moved to different locations on the island at various stages. Dunraven (1877, 56) placed it at the W gable of St. Caimin's church and in 1984 it was noted at the N gable (McNamara 1984, 32, no. 3). McNamara also noted a 'round blue sandstone' weighing 5kg in the basin which is no longer present.
CL029-009014-	Inishcaltra or Holy Island	Cross - High cross	569821E, 685050N	A wheeled high cross, the upper portion of which is mounted on the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra, 7.82m from the E end. The shaft is mounted on a cross-base 5m W of the round tower (CL029-009010-). Described by Macalister (1916-17, 150) as 'a large elaborate cross (H 6ft 3in [1.9m], arms 2ft 7.5in [0.8m] across, T 6in [0.15m]) broken into many pieces, restored with cement and fastened to the wall of the church... The cross has five bosses, one in each arm and one in the middle and these were decorated with basketwork... The background, confined within the heavy frame that surrounds the edge of the face, is covered with a minute interlacing pattern. On the dexter side ... the arm end bears a representation of Adam and Eve. On the sinister side is a key pattern; there was a figured panel on the arm-end on this side also, but it is broken, and only about half remains. The surviving part seems to bear a figure walking, holding a long staff, but the intention of the sculptor can no longer be recovered'. The shaft, which at that stage was with the top in the church, bore a plait. The base (H 1m) is oval in plan (1m x 0.5m) with its sides curved in outline and tapering to 0.55m at the top. Macalister (ibid., 147) described the socket as 1ft 2in by 9in (0.35m x 0.22m) with a depth of 9in (0.22m) and estimated that no cross on the island would fit it. The shaft of the cross was mounted on the base by the OPW at a later date. De Paor (2013, 44) states that the cross may be dated with some confidence to the ninth century. Iniscealtra is a national monument in state care, no. 5.
CL029-009015-	Inishcaltra or Holy Island	Church	569867E, 685067N	Situated in the N sector of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, this building is called 'Baptism Church' on the 1840 OS 6-inch map and 'Teampull na bhfear ngonta (in ruins)' on the 1920 OS 6-inch map. A ruined, rectangular, Romanesque structure

				(ext. dims. 5.8m E-W; 4.2m N-S; wall T 0.6m at S, 0.8m at W) of large, roughly coursed, squared blocks on a plinth (projecting 0.18m; H 0.2m). Squared quoins (0.11m x 0.11m) project 0.04m from each face at the corners and this squared feature continues along the base of the walls just above the plinth. The walls survive to a maximum height of 1.85m at W. There is no evident entrance. A window at W had an internal splay but has been robbed out (Wth 0.6m; H 1.5m). The lower courses of an ope survive at S near the W gable (Wth 0.66m; H 0.86m). Another ope at the E end of the N wall (Wth 0.8m; H 0.3m) has an external splay (ext. Wth 1.18m). None of the opes go to ground level. Macalister (1916-17, 136) interprets all three opes as entrances. An altar (Wth 1.5m; projecting 0.5m) occupies the E end and is capped with large broken flags (1.75m x 0.8m). A wall extends for 3.06m from the NE corner and is butted to the E wall. The building was extensively reconstructed, probably around 1700 (De Paor 2013, 28). According to Ó Carragáin (2010, 223) this is a mortuary chapel used for the burial of particular classes of people. Iniscealtra is a national monument in state care, no. 5.
CL029-009016-	Inishcaltra or Holy Island	Cross	569869E, 685048N	Situated in the SW corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A cross-base (L 0.81m; Wth 1.27m; H 0.27m) trapezoidal in shape and split through the socket into two pieces. Only the top few centimetres are shaped which according to Okasha and Forsyth (2001, 48) suggests that it was intended to be embedded in the ground. The upper surface is dressed with a groove forming a moulding around the perimeter and the SW corner has been chamfered. A worn inscription, in Irish, in one horizontal line is set along the W (longest) side and reads: '+ILAD IDECHENBOIR' (+Tomb of the ten persons). The cross-base stands NE of the centre of an almost square area (ext. L 2.4m N-S; Wth 2.3m) defined by a low kerb of thin upright stones. Some packing stones and other stones protruding from the ground may be all that remains of what Macalister (1916-17, 147) described as 'what seems to be a low carn, covered with earth, and grass-grown'. The identity of the people buried here is not known. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 146-7; Okasha and Forsyth 2001, 47-50)
CL029-009017-	Inishcaltra or Holy Island	Building	569883E, 685080N	Listed as 'Potential site - name' in the RMP (1996) based on the OS map designation. Situated on a narrow shelf on an E-facing slope immediately NE of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra and standing at one time in a circular enclosure (CL029-009132-). Although named 'Confessional' on the OS 6-inch map it is not clear that this structure had a

				<p>penitential use. A small ruined building (ext. dims. 3.1m E-W; 2.45m N-S) built of roughly coursed mortared walls surviving to 1.45m in height (max. T 0.65m). There is a plinth of different widths all around but widest at N (0.48m; H 0.25m) and there is stone paving at E and S. A doorway at E (Wth 0.57m) leads into the interior which is divided by two inclined flat standing stones. Two inclined square blocks occupy the corners at the W end of the building. These four stones occupy most of the floor space of the building. Excavation was conducted on this building and the surrounding area in the early 1970s. The upright stones in the building surrounded 'a shallow cist-like construction of limestone flags' (De Paor 2013, 37) and the 'confessional' was shown in its present form to date to around AD 1700. It had been rebuilt several times. This stone building appears to have replaced an earlier timber structure or shrine to the W (CL029-009134-) that was itself rebuilt several times. It may have been used as a reliquary. A recumbent cross-slab with a slot for an upright slab to the E were aligned with the confessional and the style suggests a tenth or eleventh-century date. Iniscealtra is a national monument in state care, no. 5. (Macalister 1916-17, 132)</p>
CL029-009018-	Inishcaltra or Holy Island	Penitential station	569929E, 685098N	<p>Named 'Station' on the 1920 OS 6-inch map and listed as 'Potential site - name' in the RMP (1996). This is described by Macalister (1916-17, 139) as a 'carn' of stones at the inner end of a 'landing stage' (CL029-009026-). This area as indicated on the OS map is completely overgrown and inaccessible.</p>
CL029-009019-	Inishcaltra or Holy Island	Bullaun stone	569817E, 685257N	<p>Situated in a very overgrown area at the N end of Inis Cealtra c. 50m from the N shore. A bullaun stone, not fully accessible (c. 0.7m NE-SW x 1.2m NW-SE; H at front 0.22m) with a circular basin (diam. 0.5m; D 0.16m), broken at the SE end. Described (Macalister 1916-17, 143-4), citing a letter from a Mr. Hibbert, as 'sandstone, with occasional small, rounded, quartz pebbles in it; undoubtedly it has been shaped [to a hexagonal form]. The flat faces and angles are too clean and sharp not to have been worked. There is a lump on one of the angles which is the only portion not cut away. The bottom is shouldered off all round, so far as I could feel.'</p>
CL029-009020-	Inishcaltra or Holy Island	Bullaun stone	569762E, 685337N	<p>A bullaun stone is indicated on the 1920 OS 6-inch map at ITM 569762, 685337 on Inis Cealtra. It is described by Macalister (1916-17, 143) as a stone (2ft 7in [0.78m] by 1ft 9in [0.53m] by 1ft 5in [0.43m]) with an oval depression (1ft 5in [0.43m] by 1ft [0.3m]; D 5in</p>

				[0.12m]) 'towards the north shore of the island'. On inspection on 21 July 2015 the area was found to be very overgrown and the bullaun stone was not located.
CL029-009022-	Inishcaltra or Holy Island	Penitential station	569800E, 684859N	Situated 2.5m from the SE shore of Inis Cealtra, c. 40m S of St. Mary's church (CL029-009008-) in a rough, marshy area. Named 'Stone' in Gothic script on the 1920 OS 6-inch map and listed in the RMP (1996) as 'Potential site - name'. The monument comprises 3 stones. An unworked conglomerate base stone (Wth 0.74m; L 1m; H 0.22m) aligned NW-SE has a round-bottomed channel (Wth 0.2m; D 0.12m) extending along its long axis. Two limestone slabs are attached on top, overhanging the channel and meeting along its long axis. The larger slab (max. L 0.98m; max. Wth 0.4m; T 0.13m) is at NE. It has a pronounced convex curve on its NE face and a less pronounced concave curve on the SW face. The smaller slab is roughly rectangular (max. L 0.5m; max. Wth 0.28m; T 0.12m). Some of the channel is exposed at each end beneath this slab. There may have been other stones covering each end (Macalister 1916-17, 144). This group of stones is known traditionally as the 'Bargaining stone' as people joined hands through the channel to seal a bargain or a promise.
CL029-009023-	Inishcaltra or Holy Island	Ritual site - holy well	569828E, 684905N	Set into the base of the steep SE-facing slope down to the shore, 30m E of St Mary's church (CL029-009008-) and just a few metres from the water's edge. Named 'Lady Well' on the 1920 OS 6-inch map. A circular walled structure (int. diam. 1.7m; wall Wth 0.7m; max. H on downslope 1.2m) with a lintelled opening (H 0.9m; Wth 0.3m) at SE. The water (D 0.05m) is covered in algae. Excavations by de Paor in 1970 (de Paor 2013, 29-30) on the approach side revealed objects, almost all dated to the 20th century with a few stretching back into the late 19th century. The well itself was pumped dry and excavated revealing small objects corresponding to those found outside. There was no evidence of medieval usage and the well construction was modern. The well featured in the pattern rounds of the early 19th century (de Paor 2013, 29).
CL029-009024-	Inishcaltra or Holy Island	Bullaun stone	569936E, 685177N	Situated under some bushes in a very overgrown area at the NE corner of Inis Cealtra and c. 100m N of the 'Confessional' (CL029-009017-). This bullaun stone (Wth N-S 1.1m; traceable Wth E-W 0.8m; traceable H 0.3m) has an oval basin (0.46m N-S; 0.35m E-W) and is completely ivy-covered. (Macalister 1916-17, 143, no. 4; McNamara 1984, 32)
CL029-009025-	Inishcaltra or Holy Island	Bullaun stone	569955E, 685108N	Situated in the water c. 10m from the E shore of Inis Cealtra. Weirs associated with the Ardnacrusha power station as part of the Shannon Hydro-electric scheme caused the level of

				the lake to rise and the shoreline to be flooded. A number of rocks are partially submerged in the area and this is the largest (1.5m x 0.85m; H 0.8m), it is subrectangular in plan with a straight NE side. The top of the boulder is very uneven and there is one circular basin (diam. 0.37m; D 0.12m at E and 0.07m at the lower W side) on the SW side. (Macalister 1916-17, 143; McNamara 1984, 32)
CL029-009026-	Inishcaltra or Holy Island	Slipway	569931E, 685091N	Indicated and named 'Landing stage' on the 1920 OS 6-inch map and listed in the RMP (1996) as 'Potential site - name'. Described by Macalister (1916-17, 139) as a boat-pier of large undressed blocks of stone, rectangular in plan (L 49ft (14.9m); H towards the lake edge 3ft3in (0.99m)). A possible penitential station (CL029-009018-) was apparently on the inner end of this landing stage. This area as indicated on the OS map is completely overgrown and inaccessible.
CL029-009028-	Inishcaltra or Holy Island	Bullaun stone	569815E, 685011N	One of two bullaun stones located c. 35m SSW of the round tower (CL029-009010-) on Inis Cealtra. The other bullaun stone (CL029-009029-) is 0.9m to the N. A fairly flat rectangular stone (L 1.9m NNW-SSE; Wth 0.9m) is exposed at ground level and contains a circular water-filled depression (diam. 0.61m; D 0.21m) at the NNW end. Portion of the side of the depression at NW is broken away. A 4m square cutting around the adjacent bullaun was excavated in 1977 (de Paor 2013, 42-3). Numerous finds from the upper layers included whetstones, knife-blades, nails, clay pipe fragments, burnt bone, mortar, slag and chert chippings. An extension to this cutting in 1979 revealed this second bullaun. The soil near the two bullauns was heavily mottled with charcoal flecks and burnt material. A part of a stone pestle was also found which may have been used in the hollows of the bullauns. McNamara (1984, 31-2) described the two adjacent boulders as very similar in shape with depressions in similar locations on both.
CL029-009029-	Inishcaltra or Holy Island	Bullaun stone	569817E, 685012N	One of two bullaun stones located c. 35m SSW of the round tower (CL029-009010-) on Inis Cealtra. The other bullaun stone (CL029-009029-) is 0.9m to the S. A low, roughly rectangular, limestone boulder (max. H at S 0.33m; L 1.8m NNW-SSE; Wth 1.1m) with rounded ends and a slightly convex upper surface. A subcircular depression (diam. 0.52m x 0.48m, D 0.24m) lies slightly S of centre. The depression is deep in relation to the height of the stone. A 4m square cutting around this bullaun was excavated in 1977 (de Paor 2013, 42-3). Numerous finds from the upper layers included whetstones, knife-blades, nails, clay pipe

				fragments, burnt bone, mortar, slag and chert chippings. An extension to this cutting in 1979 revealed the second bullaun (CL029-009028-). The soil near the two bullauns was heavily mottled with charcoal flecks and burnt material. A part of a stone pestle was also found which may have been used in the hollows of the bullauns. McNamara (1984, 31-2) described the two adjacent boulders as very similar in shape with depressions in similar locations on both.
CL029-009030-	Inishcaltra or Holy Island	Graveyard	569872E, 685057N	Situated on an E-facing slope immediately E of St. Caimin's church (CL029-009011-) on Inis Cealtra. This is known as the 'Saint's graveyard' and according to de Paor (2013, 44) it was laid out and walled in the twelfth century or just before it. A trapezoidal area (30m N-S at wider end; 25m E-W) defined by a well-built, mortared, roughly coursed wall with occasional large blocks. The wall is highest at W (int. H 1.3m; ext. H 0.8m; T 0.8m) and lowest at E (int. H 0.5m; ext. H 1m; T 0.55m) and is cross-capped with rough slabs along the N side and at the N end of the W side. The E wall acts as a retaining wall as there is a very steep slope on the exterior in an area that may have been an orchard. There is a round-headed entrance feature on the W wall (Wth0.98m; H 1.9m; T 0.7m). According to Macalister (1916-17, 142) the entrance is old but the round-headed top has been repaired with one of the voussoirs having been borrowed from the doorway into the enclosure at St. Brigid's church (CL029-009006-). The walls were repaired and coped by the Board of Works. A small church, Teampull na bhfear ngonta (CL029-009015-) is in the NW quadrant of the graveyard and there are a large number of recumbent graveslabs and cross-slabs in their original locations. During excavations on the island in the 1970s the growth around these slabs was cut back and the slabs were drawn but not disturbed (de Paor, SMR file). A small number of modern burials are also present. This graveyard and all of the monuments on the island are national monuments in State care.
CL029-009031-	Inishcaltra or Holy Island	House - 18th/19th century	569905E, 685120N	Near the E shore of Inis Cealtra in Lough Derg c. 40m NE of the 'Saint's Graveyard' (CL029-009030-). The foundations of a small two-roomed building excavated by de Paor in 1970 (Licence no. E000180, report 2, Area 2, 49-51). Described by Macalister (1916-17, 140) as a structure (34ft (10.3m) by 18ft (5.4m)) of drystone masonry, very roughly built (wall T 2ft 6in (0.76m); H 3ft (0.91m)) with a central chimney and back-to-back fireplaces. In spite of being cleared out by the Board of Works in 1879-80 it was clear that the floor had sloped steeply. The interior of the cottage and a small area around it was excavated. Finds were few and

				seemed to relate to the occupation of the building. Two fragments of querns were found inside, one to the W of the fireplace and one near the SE corner. A whetstone was found E of the chimney. Once the building had fallen into ruin it was used as a rubbish dump. This was referred to as a church at one time but that may have been in an effort to increase the number of churches on the island to seven (Macalister 1916-17, 140-41). Macalister also suggests that this is the 'one house' mentioned in an early 17th-century report by a Bishop Rider but on the basis of the few finds from excavation de Paor estimates a mid-18th century date. On inspection in 2016 this area was found to be completely overgrown and inaccessible. (de Paor 2013, 28, 30-31)
CL029-009032-	Inishcaltra or Holy Island	Cross-slab	569855E, 685060N	Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a cross-slab that according to Macalister (1916-17, 151, no. 21, and plate XVI) was on the N wall of the chancel of St. Caimin's church (CL029-009011-), on Inis Cealtra (Holy Island), Co. Clare. It was noted by de Paor in the 1970s (SMR file) on the S wall of the nave of the church. It is now in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151006-). Macalister (ibid.) described the slab as of 'Eighth-century type'... 'A stone, measuring 1 foot 7 inches by 1 foot 1 inch by 3 inches [0.48m by 0.33m by 0.07m]. Within a circle of two lines, a cross formed of four arcs of circles, interlacing at the intersection; the ends of the arcs are terminated with a spiral treatment. In the cantons are triskeles of one line.'
CL029-009033-	Inishcaltra or Holy Island	Cross-slab	569862E, 685060N	Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a recumbent cross-slab in the Saint's Graveyard (CL029-009030-) on Inis Cealtra (Holy Island), Co. Clare. It is visible still in situ in a photograph from de Paor's excavation report (1997) and was indicated as such on his plan (SMR file). It was exhibited in Mountshannon in August 1982 and was then placed for safe keeping in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151007-). The slab (H 1.6m; Wth 0.59m; T 0.06m) has a ringed Latin cross in false relief. All four terminals have semicircular expansions, that of the shaft dividing into two petals. There is four-pointed recess at the centre of the cross. There are the outlines of two shod feet on the right hand side, the right foot above the arm of the cross and the left foot below it, both pointing to the top. Macalister suggests that this may indicate that the person commemorated was a pilgrim. The inscription which is incised in two lines above the head of the cross and inverted reads 'COSCRACH LAIGNECH' (Coscrach the Leinsterman). The

				form of this cross is unique at Inis Cealtra and is dated by Macalister to the 10th century. (Macalister 1916-17, 153, no. 31, and plate XX; Okasha and Forsyth 2001, 58-61)
CL029-009034-	Inishcaltra or Holy Island	Sundial	569846E, 685056N	Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a sundial that according to Macalister (1916-17, 167, no. 92, and plate XXIV) was on the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra (Holy Island), Co. Clare. It is now in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151008-) (L 1.46m; Wth at top 0.4m; Wth at base 0.36m; T 0.1m). Macalister (ibid.) described the sundial as a slab with a hole for the gnomon, pierced through the stone, and a semicircle with five rays below it.'
CL029-009035-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Not listed in the SMR (1992) or the 1996 RMP. This record is for the original location of a cross-slab that according to Macalister (1916-17, 158, no. 63, and plate XIX) was on the S wall of St. Caimin's church (CL029-009011-), on Inis Cealtra (Holy Island), Co. Clare. It was exhibited in Mountshannon in August 1982 and was then placed for safe keeping in the OPW depot in Athenry, Co. Galway where it has SMR number (GA084-151009-). The slab (H 0.96m; Wth 0.38m; T 0.06m) is irregular in shape and well-preserved. The face is dressed and deeply incised with an outline Latin cross hollowed at the angles and resting on a trapezoidal base. An inscription in two lines is incised above the cross and inverted and it reads 'ORDOMAEL PATRAIC' (with the OR overlined). It was dated by Macalister (ibid.) to the 12th century. (Okasha and Forsyth 2001, 83-5)
CL029-009040-	Inishcaltra or Holy Island	Cross	569763E, 684967N	This record is for the original location of the arms and top of a small highly decorated cross found on Inis Cealtra. Now in Clare Museum, Ennis. For present location and details see CL033-183----
CL029-009041-	Inishcaltra or Holy Island	Cross-inscribed stone	569765E, 684972N	This record is for the original location of a sandstone gravemarker (Wth c. 0.3m; H 0.26m) with incised Chi-Rho cross (early 7th century) from the collapse of the late wall near St Brigid's church, Inis Cealtra (CL029-009006-) (de Paor 2013, 35, 68). On display in Clare Museum, Ennis (see CL033-185---- for present location and details).
CL029-009043-	Inishcaltra or Holy Island	Cross	569854E, 685099N	This stone was noted by Macalister (1916-17, 145, no. 2) at the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a tall sandstone block (H 0.31m; Wth 0.24m) with deep natural striations. A wide, deep, rectangular socket (0.16m x 0.09m) is centrally placed.

CL029-009044-	Inishcaltra or Holy Island	Cross	569854E, 685099N	This stone was noted by Macalister (1916-17, 145, no. 3) at the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a sandstone block (H 0.23m; Wth 0.37m at the base narrowing to 0.28m at the top) with a rectangular socket (0.2m x 0.1m; D 0.06m). There is some evidence of incised decoration on all faces.
CL029-009045-	Inishcaltra or Holy Island	Cross	569854E, 685099N	This stone was noted by Macalister (1916-17, 145, no. 4) at the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a sandstone block, roughly trapezoidal in shape (H 0.26m; Wth 0.3m at the base narrowing to 0.18m at the top) with a rectangular socket (0.12m x 0.08m; D 0.02m).
CL029-009046-	Inishcaltra or Holy Island	Cross	569854E, 685099N	This stone was noted by Macalister (1916-17, 145, no. 5) at the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a sandstone block, roughly trapezoidal in shape (H 0.24m; Wth 0.32m at the base narrowing to 0.23m at the top) with a rectangular socket (0.13m x 0.08m; D 0.05m). The socket has vertical sides and a flat base. A possible incised line is evident on one face.
CL029-009047-	Inishcaltra or Holy Island	Cross	569854E, 685099N	This stone was noted by Macalister (1916-17, 145, no. 6) at the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a tall sandstone block (H 0.34m; Wth 0.22m at base tapering to 0.17m at top). A rectangular socket (0.09m x 0.06m; D 0.05m) with sloping sides is at the top.
CL029-009049-	Inishcaltra or Holy Island	Cross	569854E, 685099N	This stone was noted by Macalister (1916-17, 145, no. 6) at the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra; it is now located in the OPW chalet on the island. The base of a cross comprising a conical sandstone block (H 0.34m; diam. 0.36m at base narrowing to 0.19m at the top) with a rectangular socket (0.08m x 0.05m; D 0.07m) off-centre at the top. The top of the stone is broken and so the socket is incomplete.
CL029-009050-	Inishcaltra or Holy Island	Cross	569889E, 685081N	Situated 3.6m from the E door of the 'Confessional' (CL029-009017-) on Inis Cealtra. A cross-base described by Macalister (1916-17, 145, no. 9) as a stone 0.48m [1ft7in] high with a socket 0.35m [1ft 2in] square by 0.12m [5in] deep.

CL029-009051-	Inishcaltra or Holy Island	Cross	569872E, 685057N	Located at the head of a cross-slab (CL029-009111-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A cross-base (H 0.2m) with a rectangular base (L 0.3m; Wth 0.25m) tapering gently to a square upper surface (L 0.2m; Wth 0.2m) which contains a shallow rectangular mortise (L 0.12m; Wth 9cm; D 0.05cm). (Macalister 1916-17, 146, no. 10)
CL029-009052-	Inishcaltra or Holy Island	Penitential station	569730E, 685091N	Situated in a small clearing in a very overgrown area close to the site of St. Michael's church (CL029-009004-) on Inis Cealtra. A flat boulder with a smooth, trapezoidal shaped, upper face (max. L 1.25m; max. Wth at E 1m; Wth at W 0.43m; traceable H 0.38m). According to the OS Letters (O'Flanagan 1927, vol. 2, 228), pilgrims went '7 times round a large flag stone [at St. Michael's garden]....on which they finally (i.e. after having gone round it 7 times) impressed kisses.' The way into the clearing had been recently opened as there had been a gathering on the island for Mass. A stone step (Wth 1.65m) adjacent to the stone may have been associated with St. Michael's church.
CL029-009053-	Inishcaltra or Holy Island	Cross	569872E, 685057N	Located 9.16m from the S wall and 9.57m from the E wall of the Saint's graveyard (CL029-009030-) on Inis Cealtra (a short distance from the location indicated on Macalister's plan of the graveyard (1916-17, 147, no. 13 and Pl. XV) and in a different orientation). A stone (L 1.2m; Wth 0.44m) with a large socket (L 0.94m; Wth 0.15m; D 0.12m), possibly a cross-base. There is a slight dip on the E side of the socket.
CL029-009054-	Inishcaltra or Holy Island	Cross	569845E, 685062N	Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) and 5.02m from the W gable. Described by Macalister (1916-17, 147, no. 14) as a slab cut into the shape of a cross (H 1.86m [6ft 1.5in]; T 0.07m [2.75in]), hollowed at the angles but without a surrounding wheel. There is no ornamentation except for a groove following the line of the edge. The left arm is partially broken, the original breadth was 0.95m [3ft 1.5in]). Two square panels one on each side at the base each contain a saltire cross in false relief.
CL029-009055-	Inishcaltra or Holy Island	Cross	569845E, 685062N	Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) and 6.42m from the W gable. Described by Macalister (1916-17, 147, no. 14 and Pl. XVII) as an important cross, once smashed to pieces but collected and cemented together by the Board of Works. This highly ornamented cross (H 1.59m; Wth across arms 0.97m; T 0.08m) was carved from a large slab and, similar to CL029-009054-, it has hollowed angles, no surrounding wheel and two rectangular panels at the base on either side of the shaft. Most of the left side panel at the base is missing. A roll moulding extends all around the outline of the cross and the arms

				and shaft had elaborate interlace that is now very faded. All that can be seen on the left side-panel are two boss-like objects, but on the right panel there is a quadruped, perhaps a unicorn, with the leg of a devoured human protruding from its mouth (Harbison 1992, 98, and pls 317 and 1015). On both sides there is text starting at the outer edge of the underside of the arm and reading down along the shaft. The right-hand text reads 'OR DOARDSE[N]OIR HERENN I DO CATHAS[A]' and the left-hand text reads 'OR DO TH[-O] DORIGNIICROI-' (Okasha and Forsyth 2001, 52). (Okasha and Forsyth 2001, 50-56)
CL029-009056-	Inishcaltra or Holy Island	Cross	569845E, 685062N	Located on the N wall of the nave of St. Caimin's church (CL029-009011-) and 8.85m from the W gable. Described by Macalister (1916-17, 149-50, no. 16) as a small wheeled cross with the openings between the wheel and the cross not pierced through. Macalister gives the dimensions as H 0.86m [2ft 10in]; Wth at base 0.35m [1ft 2in]; T at base 0.17m [7in] tapering to 0.08m [3.5in]. The cross is mounted on some smaller stones at the base.
CL029-009057-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Located on the S wall of the nave of St. Caimin's church (CL029-009011-) and 3.27m from the E end. A sandstone slab noted by Macalister (1916-17, 151, no. 18) as of 'Eighth-century type' and described as a stone (0.39m [1ft 3.5in] by 0.44m [1ft 5.5in] by 0.06m [2.5in]) bearing a Latin cross of one line with forked ends. The ends expand at the upper and lower ends and contract at the side ends.
CL029-009058-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Cemented to the S wall of the nave of St. Caimin's church (CL029-009011-) and 3.75m from the E end. Noted by Macalister (1916-17, 151, no. 19) as of 'eighth-century type' and described as a stone (0.45m [1ft 6in] by 0.41m [1ft 4.5in] by 0.07m [3in]) bearing a plain one-line Greek cross within a circle. The whole of the circle is recessed about 0.006m [$\frac{1}{4}$ in] beneath the surface of the stone.
CL029-009059-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Cemented to the S wall of the nave of St. Caimin's church (CL029-009011-) and 1.6m from the E end. A sandstone slab (H 0.67m; Wth 0.47m; T 0.09m) noted by Macalister (1916-17, 151, no. 20) as 'of eighth-century type' and described as 'a stone bearing a Greek cross of four lines within a square of two lines; four-line diagonals are stopped by two-line circles in the cantons of the cross. The angles of the cross are hollowed and all joints are mitred.' There is an inscription in one horizontal line, divided between the two upper quadrants of the cross. It is in half-uncial script and reads 'MUIR[-]A[I]TH'. If the penultimate letter were a C rather than a T, then the text could be a form of the name 'Muiredach'. According to

				Okasha and Forsyth (2001, 95-6) this stone was first recorded in 1880 when it was in the graveyard but not in situ and it was in St. Caimin's church when Macalister saw it but he seems not to have noticed the text. (Okasha and Forsyth 2001, 95-7)
CL029-009060-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Located on the ground (loose) against the S wall of the nave of St. Caimin's church (CL029-009011-) and 0.43m from the E end. Noted by Macalister (1916-17, 152, no. 22) as of 'eighth-century type' and described as a 'stone 1ft 5in (0.43m) by 1ft 7in (0.48m) by 2in (0.05m), bearing a cross 'pattée' in a circle; ovals at the ends of the arms of the cross, and trefoils in the cantons.'
CL029-009062-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	Located on the ground (loose) against the N wall of the nave of St. Caimin's church (CL029-009011-) and 3.15m from the W gable. Noted by Macalister (1916-17, 152, no. 24) as of 'Eighth-century type' and described as a 'stone, 1ft 8in (0.5m) by 1ft 2in (0.35m) by 6in (0.15m). Cross of similar design to the last (CL029-009061-) (i.e. a cross 'pattée' in a circle), but interlacements in two of the cantons, and a leaf-pattern in the other two, instead of the trefoils.'
CL029-009063-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	Located on the ground (loose) against the N wall of the nave of St. Caimin's church (CL029-009011-) and 4.27m from the W gable. An irregularly shaped slab (L 0.53m; max. Wth 0.44m; T 0.09m) with a much worn elaborate cross framed by two lightly incised circles. Noted by Macalister (1916-17, 152, no. 25) as of 'eighth-century type' and described as having a concave surface with a cross similar to several others (CL029-009060-, CL029-009061- and CL029-009062-) but with trefoils on both arms and cantons. He noted that the design was very faint and worn with the lines being no broader than pencil scribings.
CL029-009064-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Mounted on the S wall of the nave of St. Caimin's church (CL029-009011-) and 2.44m from the E end. A sandstone slab (H 0.39m; Wth 0.53m; T 0.05m) noted by Macalister (1916-17, 152, no. 27) as 'of eighth-century type' and described as 'a stone bearing a Greek cross in a square. There are small square expansions in the centres and at the ends of the arms. In the cantons are key-patterns of simple type, except in one where there is an interlacement derived from four triquetras.' One horizontal line of text in half-uncial script (now much deteriorated) is incised outside and to the right of the frame, just below the arm of the cross and it reads 'DERM-' followed by two or three more letters and is likely a form of the name

				'Dermait'. This stone was first recorded in 1880 when it was in the graveyard but not in situ. (Okasha and Forsyth 2001, 97-9)
CL029-009065-	Inishcaltra or Holy Island	Cross-slab	569887E, 685081N	Located 2.6m from the E door of the 'Confessional' (CL029-009017-) on Inis Cealtra. A socket for an upright slab extends across the slab at the head of the cross. Noted by Macalister (1916-17, 152, no. 28) as 'of ninth-century type' and described as 'a stone bearing a 'Celtic' cross in cavo rilievo [false relief].' Macalister also mentions that one 'Delany' remembered a slab standing in the socket, which he described as being about 1ft high. He could not remember if it was inscribed or ornamented in any way.
CL029-009066-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Located against the S wall of the nave of St. Caimin's church (CL029-009011-) and 1m from the E end. Noted by Macalister (1916-17, 152-3, no. 29) as of 'tenth-century type' and described as 'a slab, measuring 3ft 9in (1.14m) by 2ft 6in (0.76m) bearing ...a Latin cross with circular expansion at the centre, having a spiral pattern...in the middle of the circle... The terminal expansions are semicircular and contain key-patterns of common type.' Macalister also notes that the cross is very similar to the Clonmacnoise type of this period and may have been produced by a Clonmacnoise artist. Apart from the flat decorated face, the slab is rough and unworked with an unusual shape, rounded at the sides and coming to a point at the top.
CL029-009067-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Located against the S wall of the nave of St. Caimin's church (CL029-009011-) and 8.56m from the E end, this slab (H 0.96m; Wth 0.48m; T 0.06m) previously lay in the chancel of the church (Okasha and Forsyth 2001, 56). Noted by Macalister (1916-17, 153, no. 30) as of 'tenth-century type'. The slab is broken in two pieces and bears an incised Latin cross with squared expanded terminals and square expansions at the centre. There is a small dent on the lower part of the left terminal. An inscription is incised in one horizontal line above the head of the cross and upside down with respect to it. It reads 'OR DO MURCHAD'. The cross and inscription occupy the whole of the dressed face with the terminals reaching the edges. (Okasha and Forsyth 2001, 56-8)
CL029-009068-	Inishcaltra or Holy Island	Graveslab	569876E, 685069N	This graveslab is in the middle of a composite grave in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. This particular slab lies 3.05m from the N wall of the graveyard and 3.3m from the E wall of Teampul na bhFear nGonta (CL029-009015-). Noted by Macalister (1916-17, 154) as of 'twelfth-century type' the slab (L 1.45m; Wth 0.46m; T 0.06m) is broken into three large pieces with several smaller pieces missing. An inscription occurs on what is now

				the middle piece and it is incised in a single line along the long axis of the stone. The text is incomplete and reads 'OR DO MACCU'. This is the only inscribed stone on the island that contains no cross (Macalister <i>ibid.</i>). (Okasha and Forsyth 2001, 61-4)
CL029-009069-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated towards the centre of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (18.5m from the S wall and 9.9m from the W wall). Noted by Macalister (1916-17, 154, no. 33) as of 'twelfth-century type' and described as 'a slab, 3ft 1in (0.93m) by 1ft 2in (0.35m), apparently imperfect at both ends' with a plain Latin cross of two lines.
CL029-009070-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the NE quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (4.6m from the N wall and 6.61m from the E wall). Noted by Macalister (1916-17, 154, no. 34) as of 'twelfth-century type' and described as 'a slab, measuring 4ft 6in (1.37m) by 1ft 6in (0.45m), with a plain Latin cross of two lines.'
CL029-009071-	Inishcaltra or Holy Island	Cross-slab	569785E, 684918N	Erected against the N wall of the nave of St. Mary's church (CL029-009008-) on Inis Cealtra and 7.75m from the W gable. Noted by Macalister (1916-17, 154, no. 35) as of 'twelfth-century type' and described as 'a slab, 4ft 9in (1.44m) by 1ft 8in (0.5m), with a plain Latin cross of two lines, boldly cut.'
CL029-009072-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	Located against the N wall of the nave of St. Caimin's church (CL029-009011-) and 2.55m from the W gable. A trapezoidal shaped slab noted by Macalister (1916-17, 154, no. 36) as 'twelfth-century type' and described as '6ft (1.82m) by 2ft 3in (0.68m), tapering to 1ft 9in (0.53m) by 5in (0.12m) thick, bearing a plain Latin cross of two lines. There is a square hole cut above the head of the cross, 1 5/8 in deep (0.04m). The surface of the cross is very friable, and is much weathered; the cross can only just be traced, and will before long be entirely scaled away.' The roofing of St. Caimin's church has helped to halt the deterioration of the slab.
CL029-009073-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated close to Teampul na bhFear nGonta (CL029-009015-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra 18.9m from the S wall and 10.6m from the W wall. A cross-slab noted by Macalister (1916-17, 154, no. 37) as a 'twelfth-century type' and described as 'a slab, now 3ft 5in (1.04m) by 1ft 7in (0.48m), but the bottom is broken away, carrying with it the lower end of the cross.' Macalister describes this slab as 'similar to the preceding' which is no. 36 (CL029-009072-) which has a plain Latin cross of two lines.

CL029-009074-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the E side of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.23m from the N wall and 6.05m from the E wall). Noted by Macalister (1916-17, 154, no. 38) as of 'twelfth-century type' and described as 'a slab, 5ft 5in (1.65m) by 1ft 10in (0.55m); the long edges are rebated, the rebate being 5/8in (0.01m) deep and 2in (0.05m) broad. Plain Latin cross, ...much worn and flaked.' While the cross is no longer evident to the eye, faint traces of the uppermost arm and left arm of the cross were made out in a rubbing (pers. comm. Clíodhna O'Leary, 22 April 2016).
CL029-009075-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated close to the entrance to the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (10.3m from the S wall and 2.9m from the W wall). Noted by Macalister (1916-17, 154, no. 39) as of 'twelfth-century type' and described as 'a slab, 5ft 4in (1.62m) by 1ft 6 1/2in (0.46m)...Plain Latin cross...left open at the bottom.'
CL029-009076-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated close to the entrance to the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (14.3m from the S wall and 3m from the W wall). Noted by Macalister (1916-17, 155, no. 40) as of 'twelfth-century type' and described as 'a slab, 5ft 2in (1.57m) by 2ft (0.6m)...Latin cross, the middle flaked away, the bottom left open. The side lines are bent outward at right angles, and prolonged to reach the edges of the slab.'
CL029-009077-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (8.93m from the N wall and 6.16m from the E wall). A cross-slab (L c. 1.93m; Wth 0.8m; T c. 0.07m) now in three pieces with some missing. Noted by Macalister (1916-17, 155, no. 41) as of 'twelfth-century type' with a Latin cross with rectangular expanding base, open at the bottom where it met the end of the slab. An incomplete inscription on the stem of the cross reading upwards reads 'OR DO CHELLACH'. The slab was defaced previous to Macalister's visit by being used as a table to mix mortar. (Okasha and Forsyth 2001, 65-7)
CL029-009078-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Located against the S wall of the nave of St. Caimin's church (CL029-009011-) and 5.88m from the E end. Noted by Macalister (1916-17, 155, no. 42) as of 'twelfth-century type' and described as 'a slab 5ft 2in (1.57m) by 1ft 9 1/2in (0.54m) by 4 1/2in (0.11m). Plain Latin cross of two lines, with a base formed by oblique lines running downward from the lower corners of the stem. The surface of the slab is deeply scored with straight grooves; apparently it has been used at some time for sharpening tools.'

CL029-009079-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Located in the SW corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (3.3m from the S wall and 2.1m from the W wall). A cross-slab noted by Macalister (1916-17, 155, no. 43) as of 'twelfth-century type' and described as a slab, 5ft 2in (1.57m) by 2ft 5in (0.73m), with a Latin cross in high relief, 3 ½in (0.08m) above the background. This cross-slab is now much weathered.
CL029-009080-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Immediately inside the entrance to the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (12.3m from the S wall and 2.8m from the W wall). A cross-slab noted by Macalister (1916-17, 155, no. 44) as of 'twelfth-century type' and described as a slab 5ft 1 1/2in (1.56m) by 1ft 9in (0.53m) with a plain Latin cross on a trapezoidal base with slightly hollowed sides and a groove on the base running parallel with its outline. The top of the base is in relief, sloping to the level of the background at the bottom.
CL029-009081-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	This graveslab lies immediately S of a composite grave in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 5.5m from the N wall of the graveyard and 3.3m from the E wall of Teampul na bhFear nGonta (CL029-009015-). Noted by Macalister (1916-17, 155, no. 45) as of 'twelfth-century type' the slab (L 1.55m; Wth 0.5m; T 0.08m) has a Latin cross in relief on a trapezoidal base with concave sides. At the E end of the slab, above the cross and of a piece with it, is a panel which extends the full width of the slab. This panel contains two lines of text in Irish, upside down in relation to the cross. The top right corner is now broken off and the start of the text is missing. It was complete, although still difficult to decipher, in 1916 when it read: 'OR DO CATHGAL'. The slab is exceptional in having the head of its cross (and the text) at the E end. (Okasha and Forsyth 2001, 67-9)
CL029-009082-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Located in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (12.6m from the N wall and 4.06m from the E wall). A cross-slab noted by Macalister (1916-17, 156, no. 46) as of 'twelfth-century type' and described as a slab, 4ft 1in (1.24m) by 1ft 4 1/4in (0.41m), with three small crosses in a row at the upper end. In the middle is a Greek cross in relief. To the left is a Latin cross with a cross-shaped groove running over its surface and to the right is a Latin cross pattée, both in false relief.
CL029-009083-	Inishcaltra or Holy Island	Cross-slab	569852E, 685062N	Mounted on the E wall of the nave of St. Caimin's church (CL029-009011-) on the return before the entrance into the chancel. Noted by Macalister (1916-17, 156, no. 47) as of 'twelfth-century type' and described as a slab measuring 3ft 1in (0.93m) by 1ft 1in (0.33m) by

				1 3/4in (0.04m) with a Latin cross with the angles hollowed with circular cuttings and the base open. Portion of the top of the slab is now missing.
CL029-009084-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated immediately W of Teampul na bhFear nGonta (CL029-009015-) in the Saint's Graveyard (CL029-009030-) on Inis Cealtra, 23.4m from the S wall and 3.9m from the W wall. Noted by Macalister (1916-17, 156, no. 48) as of 'twelfth-century type' and described as a slab measuring 5ft 4in (1.62m) by 2ft (0.6m) bearing a Latin cross with the angles hollowed by circular cuttings. A rectangular panel around the cross-head throws it into false relief.
CL029-009085-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated close to the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (21.3m from the S wall and 1.9m from the W wall). Noted by Macalister (1916-17, 156, no. 49) as of 'twelfth-century type' and described as a slab measuring 3ft 3in (0.99m) by 1ft 10in (0.55m), with a Latin cross in low relief with the angles hollowed with circular cuttings. (de Paor drawing, SMR file)
CL029-009086-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the SW quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (8.3m from the S wall and 2.5m from the W wall). Noted by Macalister (1916-17, 156, no. 50) as of 'twelfth-century type' and described as a slab measuring 5ft 6in (1.67m) by 2ft 6in (0.76m), with a Latin cross with hollowed angles and the lower shaft angled outwards to form a base. The slab is broken and the lower left portion is missing. (de Paor drawing, SMR file)
CL029-009087-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the NE quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.52m from the N wall and 4.06m from the E wall). Noted by Macalister (1916-17, 156, no. 51) as of 'twelfth-century type' and described as a slab measuring 5ft 6in (1.67m) by 1ft 10in (0.55m), tapering down to 1ft 5in (0.43m), with a Latin cross with hollowed angles and the lower shaft angled outwards to form a base. A 2in (0.05m) rebate extends down the long sides and Macalister describes the slab as slightly hog-backed. (de Paor drawing, SMR file)
CL029-009088-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Mounted against the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 6.62m from the E end. A cross-slab (L 1.19m; Wth 0.42m; T 0.16m) noted by Macalister (1916-17, 156, no. 52) as of 'twelfth-century type' with a Latin cross with hollowed angles and an expanding base. An inscription in two horizontal lines above the top of the cross and upside down with respect to it reads 'OR DOLAITH BERTACH'. The same name occurs on another cross-slab (CL029-009198-) in St. Caimin's church. (Okasha and Forsyth 2001, 69-71)

CL029-009089-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (14.3m from the S wall and 7.9m from the W wall). Noted by Macalister (1916-17, 156, no. 53) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 71-2) as a large recumbent cross-slab (H 0.91m; Wth 0.61m; T 0.04m) now broken and incomplete. The slab would have been c. 1.45m in length originally. All that remains is one large piece broken in two with an incised Latin cross with hollowed angles. Macalister (ibid., pl. XIX) shows the incised cross with an expanded base or platform with concave sides. There is an inscription, most of which is in a horizontal line across the top of the cross, with one letter inside the upper arm of the cross. The text is complete and reads: 'OR D.. INGANE'. (Okasha and Forsyth 2001, 71-3)
CL029-009090-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.88m from the N wall and 6.05m from the E wall). Noted by Macalister (1916-17, 157, no. 54) as of 'twelfth-century type' and described as a slab measuring 5ft 5in (1.65m) by 1ft 8in (0.5m), with a Latin cross with hollowed angles, at the base of the shaft the lines bend outward at 90 degrees and extend to the edges of the slab. (de Paor drawing, SMR file)
CL029-009091-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (5.38m from the N wall and 6.16m from the E wall). Noted by Macalister (1916-17, 157, no. 55) as of 'twelfth-century type' and described as a slab measuring 4ft 2in (1.27m) by 1ft 6in (0.45m), with a Latin cross with hollowed angles. At the base of the shaft the lines bend outward at 90 degrees and extend to the edges of the slab. (de Paor drawing, SMR file)
CL029-009092-	Inishcaltra or Holy Island	Cross-slab	569855E, 685093N	Lying on the ground to the S of the OPW chalet on Iniscealtra, among other architectural fragments. A cross-slab depicted in the W half of the 'Saint's graveyard' (CL029-009030-) on Macalister's plan (1916-17, pl. XV) and described (ibid., 157, no. 56) as a cross-slab of 'twelfth-century type' 4ft 10in (1.47m) by 1ft 5in (0.43m) with a double-lined incised Latin cross with hollowed angles. The arms and head of the cross extended to the edges of the slab and at the base the lines bend outwards at 90 degrees and extend to the edge also. De Paor (List 2, SMR file) noted that during his time on the island the slab was in a pile of worked stone beside the wall of the Saint's Graveyard. His drawing shows the slab as broken at a slight angle across the middle. Only the upper portion is now present (L 0.89m).

CL029-009093-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (21.5m from the S wall and 3.9m from the W wall) and close to the W wall of Teampal na bhfear ngonta (CL029-009015-). Noted by Macalister (1916-17, 157, no. 57) as of 'twelfth-century type' and described as a slab measuring 4ft 2in (1.27m) by 1ft 6in (0.45m), with a Latin cross with hollowed angles in 'slight relief' with the base line carried up to make a frame or panel enclosing the whole design. (de Paor drawing, SMR file)
CL029-009094-	Inishcaltra or Holy Island	Cross-slab	569876E, 685069N	A recumbent cross-slab, part of a composite grave situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (this slab is 2.5m from the N wall and 3.3m from the E wall of Teampul na bhfear ngonta (CL029-009015-). Noted by Macalister (1916-17, 156, no. 58) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 73-5) as a large cross-slab (H 1.45m; Wth 0.42m; T 0.1m), broken into two pieces with several pieces missing. The face is dressed and incised with an outline Latin cross with hollowed angles and a square base, open at the bottom. An incomplete inscription in two lines across the top of the cross reads '...DOGILLU...EPISCO' (Bishop Gilla-Críst).
CL029-009095-	Inishcaltra or Holy Island	Cross-slab	569876E, 685069N	A recumbent cross-slab, part of a composite grave situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (this slab is 3.75m from the N wall and 3.3m from the E wall of Teampul na bhfear ngonta (CL029-009015-). Noted by Macalister (1916-17, 156, no. 59) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 76-8) as a large cross-slab (H 1.39m; Wth 0.56m; T 0.9m), with a substantial piece broken off at the top right corner and a small piece broken off the bottom left corner. The face is dressed and incised with an outline Latin cross with hollowed angles and a square base, closed at the bottom. An incomplete inscription in one horizontal line above the top of the cross reads 'ORDOMAE...'.
CL029-009096-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (22.6m from the S wall and 3.6m from the W wall). Noted by Macalister (1916-17, 156, no. 60) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 78-80) as a large cross-slab (H 1.27m; Wth 0.51m; T 0.8m) with some delamination of the carved surface. The face is dressed and incised with an outline Latin cross with hollowed angles and a rectangular base, open at the bottom, with a faint line separating the shaft from the base. An complete inscription in one vertical line down the shaft of the cross reads 'ORDOMNALL[-]JACART' (oróit do Domnall [s]acart, 'a prayer for Domnall the priest').

CL029-009097-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (13.5m from the S wall and 6m from the W wall). Noted by Macalister (1916-17, 158, no. 61) as of 'twelfth-century type' and described as a slab measuring 4ft 11in (1.49m) by 1ft 4in (0.4m), with an outline Latin cross with hollowed angles and a square base, open at the bottom. (de Paor drawing, SMR file)
CL029-009098-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	Mounted against the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 0.9m from the W gable. A cross-slab (L 1.49m; Wth 0.59m; T 0.07m) noted by Macalister (1916-17, 158, no. 62) as of 'twelfth-century type' with a Latin cross with hollowed angles and an expanding base. The outline of the cross is formed by a broad flat band and there is a pellet in each of the four hollows (Okasha and Forsyth, 2001 82). An inscription in two horizontal lines above the top of the cross and upside down with respect to it reads 'ORDODIARMAIT MACCDELBAID'. (Okasha and Forsyth 2001, 81-3)
CL029-009099-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (11.65m from the N wall and 2m from the E wall). Noted by Macalister (1916-17, 158, no. 64) as of 'twelfth-century type' and described as a slab measuring 4ft 2in (1.27m) by 1ft 6in (0.45m), with a Latin cross in double lines with hollowed angles and a rectangular base. Under the base is a pattern comprising an inverted triangle flanked with series of oblique lines. The pattern is not centred to the cross. (de Paor drawing, SMR file)
CL029-009100-	Inishcaltra or Holy Island	Cross-slab	569779E, 684916N	Situated against the N wall of the nave of St. Mary's church (CL029-009008-) on Inis Cealtra and 3.3m from the W gable. Noted by Macalister (1916-17, 158, no. 65) as of 'twelfth-century type' and described as a slab measuring 1ft 10in (0.55m) by 1ft 9in (0.53m) by 3.5in (0.08m) showing the upper part of a Latin cross with hollowed angles. In Macalister's time it marked a grave outside the W end of St. Mary's.
CL029-009101-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated near the centre of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (13.7m from the S wall and 8.5m from the W wall). Noted by Macalister (1916-17, 158, no. 66) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 85-7) as a large cross-slab (H 1.77m; Wth 0.52m; T 0.6m). The face is incised with an outline Latin cross with hollowed angles. The lower part is much worn. Macalister drew a triangular base and two horizontal lines running from each side of the cross, just above the base to the edges of the stone. These are no longer evident. An incomplete inscription in one vertical line

				down the shaft of the cross reads 'OR[-]DOMNALL'. The horizontal lines mentioned above are evident in a rubbing (pers. comm. Clíodhna O'Leary, 22 April 2016).
CL029-009102-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated beside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (19.3m from the S wall and 1.8m from the W wall). Noted by Macalister (1916-17, 159, no. 67) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 87-9) as a large cross-slab (H 1.16m; Wth 0.43m; T 0.5m). The face is incised with an outline Latin cross with hollowed angles. The top and shaft are open. The arms meet lines which frame the length of the slab. The cross sits on a base of unusual shape carved in low relief, consisting of an inverted triangle with large flat bosses at the upper corners and rounded apex. The end of the slab is shaped to a rounded point. An incomplete inscription in two horizontal lines across the top of the cross reads 'SEC H NAILL [-]DOMAEL'. Taking the lower line first the text reads '...do Máel Sechnaill'.
CL029-009103-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (6.3m from the S wall and 2.4m from the W wall). Noted by Macalister (1916-17, 159, no. 68) as of 'twelfth-century type' and described as a fragment of a slab measuring 2ft 6in (0.76m) by 1ft 9in (0.53m), bearing the upper part of a cross with hollowed angles. The whole pattern was in a rectangular panel. (de Paor drawing, SMR file)
CL029-009104-	Inishcaltra or Holy Island	Cross-slab	569866E, 685067N	A recumbent cross-slab, the northernmost of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009160-, CL029-009161- and CL029-009162-). Noted by Macalister (1916-17, 159, no. 69) as 'of twelfth-century date' and described as an elaborately carved slab in which the Latin cross is ornamentally treated. It measures 6ft (1.82m) by 1ft 5in (0.43m) and the cross is in double lines on a square expanding base. The angles are cut with hollowed double squares and the head is brought to a point with lines that cross over each other. The ornamentation in the cantons suggests the wheel of a 'celtic' cross. (de Paor drawing, SMR file)
CL029-009105-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra 22m from the S wall and 4.1m from the W wall and immediately W of 'Teampul na bhFear nGonta' (CL029-009015-). Noted by Macalister (1916-17, 159, no. 70) as 'of twelfth-century date' and described as an elaborately carved slab in which the Latin cross is ornamentally treated. It measures 6ft by 1ft 9in with a cross in double lines, open at the

				base. The angles are cut with hollowed double squares and the head is brought to a point. The ornamentation in the cantons suggests the wheel of a 'celtic' cross. (de Paor drawing, SMR file)
CL029-009106-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) and 8m from the W gable. Noted by Macalister (1916-17, 159, no. 71) as of 'twelfth-century type' and described as a slab measuring 4ft 10in (1.47m) by 2ft 5.5in (0.74m) tapering down to 2ft 2.5in (0.67m) bearing a Latin cross of two lines and hollowed angles. The two lower angles are wheeled. The space between the shaft and the enclosing panel is divided into two groups by horizontal lines.
CL029-009107-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra 13.3m from the S wall and 3.2m from the W wall. Noted by Macalister (1916-17, 160, no. 72) as of 'twelfth-century type' and described as a slab measuring 6ft 4in (1.93m) by 2ft 8in (0.81m) tapering to 2ft (0.6m) bearing a Latin cross of two lines with hollowed angles enclosed in a frame. The top of the cross is pointed and there is a splayed base outside the enclosing frame.
CL029-009108-	Inishcaltra or Holy Island	Cross-slab	569791E, 684911N	Mounted against the S wall of the nave of St. Mary's church (CL029-009008-) on Inis Cealtra and 4.26m from the E gable. Noted by Macalister (1916-17, 160, no. 73) as of 'twelfth-century type' and described as a slab measuring 5ft 9.5in (1.76m) by 1ft 7in (0.48m) by 3in (0.07m) bearing a cross with hollowed angles. The cross head is in false relief as a square panel is hollowed out around the cross head. Below is a rectangular panel with interlacing double-lined diagonals. (de Paor drawing, SMR file)
CL029-009109-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (18.4m from the S wall and 7.6m from the W wall). Noted by Macalister (1916-17, 160, no. 74) as of 'twelfth-century type'. Described by Okasha and Forsyth (2001, 91-3) as a large cross-slab (H 1.76m; Wth 0.45m) tapering towards the base with an incised double-lined Latin cross with hollowed angles and a chequered pattern in the upper quadrants. An incomplete inscription in one vertical line down the shaft of the cross reads 'OR_'.
CL029-009110-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (15.45m from the S wall and 8.1m from the W wall). Noted by Macalister (1916-17, 160, no. 75) as of 'twelfth-century type' and described as a slab measuring 4ft (1.21m) by

				1ft 6in (0.4m), with a Latin cross with hollowed angles. A stepped pattern runs down the sides of the stem, below the arms of the cross and the head is likewise stepped at the top. The central portion is in false relief. (de Paor drawing, SMR file)
CL029-009111-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the SW corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (5.3m from the S wall and 2.7m from the W wall). Noted by Macalister (1916-17, 160, no. 76) as of 'twelfth-century type' and described as a slab measuring 6ft 8in (2m) by 2ft 3.5in (0.69m), tapering to 2ft 1in (0.63m) with a Latin cross of double lines with hollowed angles. The base of the stone and the whole background is covered with an ornament of squares and crosses but is much worn. (de Paor drawing, SMR file)
CL029-009112-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	A recumbent cross-slab situated in the W half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra (17.3m from the S wall and 2.7m from the W wall). Noted by Macalister (1916-17, 160-61, no. 77) as of 'twelfth-century type' and described as a slab measuring 6ft (1.8m) by 1ft 2in (0.35m) bearing a much-worn pattern. A Latin cross of double lines with hollowed angles. The base of the stone and area to the right of the shaft are covered with an ornament of squares and crosses and the left side has an interlacing pattern. (de Paor drawing, SMR file)
CL029-009113-	Inishcaltra or Holy Island	Cross-slab	569860E, 685072N	A fragment of a cross-slab (Wth 0.49m; H 0.47m), one of two fragments mounted on the outer face of the W wall of the Saint's Graveyard (CL029-009030-) on Inis Cealtra, 13.6m from the N end (see CL019-009121-). Macalister (1916-17, 161, no. 78) described part of the stem of a three-line cross in a rectangular single-line frame with simple corner pieces, one of which remained. He also noted that the lines of the carving were clogged with cement.
CL029-009118-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	Located against the N wall of the nave of St. Caimin's Church (CL029-009011-) on Inis Cealtra and 7.14m from the W gable. A cross-slab comprising an irregularly shaped sandstone slab (H 0.43m; max. Wth 0.4m) with a single-line Latin cross within a single-line frame. The upper portion is wheeled and the spandrels are decorated with angular lines. There is a circle with a central depression at the head, base and end of each arm of the cross. (Macalister 1916-17, 162, no. 83; de Paor drawing, SMR file)
CL029-009120-	Inishcaltra or Holy Island	Leacht	569872E, 685057N	Situated within the graveyard (CL029-009030-) E of St. Caimin's church on Inis Cealtra. According to the Ordnance Survey Letters (O'Flanagan 1927, vol. 2, 226) a grave, lying a few yards from the SE corner of St Caimin's church (CL029-009011-) marked the burials of 'the

				<p>twelve saints' who founded the churches on the island. He noted an uninscribed upright stone marking the location of a horizontal one that covered the grave. Many recumbent graveslabs are still in situ in the graveyard but it is not known which of them marked this 'Saint's grave'. A sketch in Petrie and Stokes 1878 (vol. 2, 41) shows four upright stones towards the SE corner of the saint's graveyard which were not to be seen in Macalister's time but which may have been associated. (Macalister 1916, 163, no. 85)</p>
CL029-009121-	Inishcaltra or Holy Island	Graveslab	569845E, 685062N	<p>Located on the ground against the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 5.78m from the W gable. The lower portion (Wth 0.49m; H 0.53m) of an elaborately decorated graveslab noted as 14th-century by Macalister (1916-17, 163). The slab was broken into three portions. The middle portion (Wth 0.43m; H 0.5m; T 0.4m) is mounted beside another graveslab fragment (CL029-009113-) on the wall near the entrance to the Saint's graveyard (CL029-009012-). The upper portion is now missing. The surface of the slab was divided longitudinally into two panels, each containing a floral pattern and there was no cross. Macalister noted (ibid., 164) that while one portion was against the wall of the nave, two portions were on the floor marking modern graves and several other pieces were missing. (Macalister 1916, 163-4, no. 86 and Plate XXIV; de Paor, drawing SMR file)</p>
CL029-009122-	Inishcaltra or Holy Island	Cross-slab	569845E, 685062N	<p>Mounted on the N wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 3.66m from the W gable. Noted by Macalister (1916-17, 164, no. 87) as of 14th century date or maybe slightly later and described as a worn slab (6ft 3in (1.9m) by 2ft 6in (0.76), tapering to 1ft 9in (0.53m); T 2.5in (0.06m)) found at St. Mary's church (CL029-009008-). It bears a cross with a rosette in the centre and floral panels filling the angles. A square panel at the base contains a four-leaved flower.</p>
CL029-009123-	Inishcaltra or Holy Island	Wall monument	569794E, 684916N	<p>Situated within St. Mary's church (CL029-009008-) on Inis Cealtra, this wall monument is in two portions, the upper portion is on the S wall, 7.5m from the E gable and the lower portion forms the altar at the E end of the church. The upper portion is described by Macalister (1916-17, 164-7, no. 88) as a triangular pediment in a moulded border flanked by pinnacles. A circular depression in the centre contains the O'Brien arms surrounded by a much worn inscription which reads: 'THIS M(ONUME)NT W(AS ERECTED) BY THE LADY S(LANEY) BRIEN (MOTH)ER TO (SR TER)LAGH(MC I BRIEN) HERE LYE THE BODIES OF THE NOBLE KNOGHT SR T(ERL)AGH M I BRIEN ARA BARONETT WHO DIED THE 28 OF MARCH ANNO DNI 1626 AND</p>

				HIS LADY (elys) BUTLER DAUGHTER TO THE RIGHT HONNORABLE WALTER EARLE OF ORMOND WHO DIED THE X OF FEB. 1625 PRAY FOR THEIR SOULES MEMENTO MORI'. The altar at the E end has a crude carving of the crucifixion flanked with stiff floral panels. According to Macalister (ibid., 166) the total height of the monument would have been 8ft 6in (2.5m) and the breadth 7ft 4in (2.23m).
CL029-009124-	Inishcaltra or Holy Island	Wall monument	569846E, 685056N	Mounted high on the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 7.82m from the E end. A slab described by Macalister (1916-17, 166-7, no. 89) as a slab (2ft 6.5in (0.77m) by 2ft (0.6m)) bearing three lions passant surrounded by a mantling in the form of floral scrolls. The date 1703 is in the two upper corners and at the base is an inscription which reads: 'VULNERATUS NON VICTUS IA GRADY REPAIRED THOS CHVRCHES AND MOWMENT (sic) TO THE GRACEC (sic) AND GLORIE OF GOD'. A chest-tomb slab (CL029-009125-) also against the S wall of the nave may have formed part of a tomb associated with the wall monument.
CL029-009125-	Inishcaltra or Holy Island	Tomb - chest tomb	569846E, 685056N	Mounted against the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 4.55m from the E end. A possible chest-tomb slab (Wth 1.29m; H 0.78m; T 0.1m) dated by Macalister (1916-17, 167, no. 90) to between 1680 and 1750. It bears the letters 'IHS' surmounted by a cross within a rectangular panel with the two upper corners cut off obliquely. This slab may have been associated with the wall monument (CL029-009124-) higher up on the S wall.
CL029-009127-	Inishcaltra or Holy Island	Headstone	569872E, 685057N	Situated in the SW corner of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra and named 'Mod. Stone' on Macalister's plan (1916-17, pl. XV). A low, thin, roughly rectangular, earthfast limestone gravemarker (H 0.49m; L 0.53m; T 0.06m). There is no visible decoration or inscription and the date of this gravemarker is uncertain.
CL029-009128-	Inishcaltra or Holy Island	Furnace	569762E, 684961N	Situated to the W of the doorway of St. Brigid's church (CL029-009006-) and within the surrounding enclosure/graveyard (CL029-009007-). Excavation by de Paor in 1970-72 (E000180) revealed a copper worker's furnace in the form of a pit in which an ovoid structure of clay had been constructed. This structure bore small splashes of copper and traces of intense heat. (de Paor 1997, 55-6; 2013, 33)
CL029-009129-	Inishcaltra or Holy Island	Metalworking site	569765E, 684967N	Situated immediately N of St. Brigid's Church (CL029-009006-) within the enclosure that surrounds it (CL029-009007-). During excavation in 1970-72 (Licence no. E000180) evidence

				of iron-working was found. Fragments of furnace-bottom were evident in one pit as well as quantities of clinker and bloom. (de Paor 2013, 34, 51)
CL029-009130-	Inishcaltra or Holy Island	Metalworking site	569743E, 684954N	To the W of the enclosure (CL029-009007-) surrounding St. Brigid's church (CL029-009006-). During excavations by de Paor in 1970-72 (Licence no. E000180) an area of intense metalworking activity was found here with numerous pits, a scatter of clinker and slag. One large pit had been repeatedly refilled with clay and redug, with small hollows showing traces of burning and containing much charcoal. A pit in this area has been radiocarbon dated to Cal AD 1034-1205 (UBA-30140) (Seaver and O'Sullivan 2015, 11-13). Two decorated querns were also found in this area. (de Paor 2013, 34, 51)
CL029-009131-	Inishcaltra or Holy Island	Enclosure	569717E, 685093N	Situated at the highest point and just W of the centre of Inis Cealtra and central to a system of fields (CL029-009002-) associated with the monastic remains on the island. A D-shaped enclosure (dims. c. 70m NE-SW; c. 47m NW-SE) with a straight bank at E (Wth 6.4m; ext. H 0.4m; int. H 1.1m). From S to NW the enclosure is defined by a bank (Wth 5.4m; ext. H 0.8m; int. H 0.5m) and from NW to NE by a bank (Wth 6.55m; int. H 0.5m; ext. H 1.4m) external fosse (Wth 1.8m at base) and external bank (Wth 3.2m; int. H 0.4m; ext. H 0.15m). The site of St. Michael's Church (CL029-009003-) and a small associated enclosure (CL029-009004-) lie within and a penitential station (CL029-009052-) in the area is still visited. The enclosure was excavated in 1972 (Excavation no. E000180) revealing a typical bank and fosse profile. There was no evidence of occupation at any period and the enclosure was D-shaped in its original form. A charcoal sample from the straight fosse at E has been radiocarbon dated to Cal AD 905-1023 (UBA-30515)(Seaver and O'Sullivan 2015, 11-14). (dePaor 2013, 36-7)
CL029-009132-	Inishcaltra or Holy Island	Enclosure	569888E, 685086N	Situated immediately N of the Saint's Graveyard (CL029-009030-) on Inis Cealtra. An overgrown enclosure (diam. c. 15m) defined by a stony bank was excavated by de Paor between 1972 and 1976 (Licence no. E000180) (de Paor 2013, 37). Excavation revealed a drystone wall similar to the enclosures (CL029-009004- and CL029-009007-) around St. Brigid's and St. Michael's churches. Some paving survived around the perimeter. The 'Confessional' (CL029-009017-) lay in the SW quadrant of the enclosure. According to de Paor (ibid.) this was a development associated with remodelling for the purpose of pilgrimage rounds in the 17th/18th century. There was no evidence of an earlier enclosure at this location and there is no enclosure extant.

CL029-009133-	Inishcaltra or Holy Island	Enclosure	569873E, 685099N	Situated c. 12m N of the Saint's Graveyard (CL029-009030-) on Inis Cealtra. An almost circular fenced enclosure (diam. c. 23m) with evidence of bronze-working was excavated in the 1970s and dated to the 11th century AD (de Paor 2013, 39, 57). Stone 'motif pieces' were found as well as bronze waste and scraps of bronze with ornament in the 'Irish Ringerike' style. A 'stain' of a possible rectangular structure was found in the interior and there were traces of one or more extremely light huts or bothies, in one case with a hearth in the centre. The enclosure overlay earlier burials associated with a graveyard or enclosure (CL029-009135-) around a wooden shrine (CL029-009134-). A pit within the enclosure yielded radiocarbon dates of Cal AD 775-962 (UBA-27539) (Seaver and O'Sullivan 2015, 12-13, 33).
CL029-009134-	Inishcaltra or Holy Island	Shrine	569872E, 685082N	Situated c. 10m NW of the 'Confessional' (CL029-009017-) on Inis Cealtra. Traces of a small, timber, rectangular structure of similar dimensions to the confessional (c. 3m x2m) and aligned N-S were found during excavations on the island by de Paor in the 1970s (de Paor 2013, 39, 57). There were traces of a pillared portico at the S end. The structure was aligned within a rectangular palisaded enclosure (CL029-009135-), the S and larger portion of which was overlain by the medieval Saint's Graveyard (CL029-009030-) and not excavated. The wooden structure and the enclosure appeared to have been rebuilt several times and the structure may have been replaced ultimately by the stone confessional. The structure was interpreted as a shrine of Christian origin but modelled on a type of shrine within an enclosure precinct known from Gallo-Roman and Romano-British contexts.
CL029-009135-	Inishcaltra or Holy Island	Graveyard	569869E, 685082N	Situated at the N wall of the Saint's Graveyard (CL029-009030-) on Inis Cealtra. A rectangular palisaded enclosure (c. 18m E-W) was found here during excavations on the island by de Paor in the 1970s (de Paor 2013, 39, 57). Only the smaller N sector was excavated as the S portion extends beneath the Saint's graveyard and this was not excavated. A wooden shrine (CL029-009134-) was excavated in the E sector. Both it and the enclosure appeared to have been rebuilt several times and according to de Paor (ibid.) probably date from a very early stage in the monastic history of the island. Sixteen poorly preserved burials were found within the enclosure, twelve of which were aligned with the enclosure and wooden shrine.
CL029-009136-	Inishcaltra or Holy Island	Enclosure	569819E, 685020N	Situated c. 30m S of the round tower (CL029-009014-) on Inis Cealtra. The NE quadrant of a circular fenced enclosure (min. diam. 30m) was excavated in 1974 (de Paor 2013, 40, 58). A lean-to structure was attached externally at NE while there was a round house (CL029-

				009137-) in the interior. According to de Paor (ibid.) the house was probably not related to the enclosure. It occurred in an area with a maze of stake-holes, wattle holes, post-holes and timber stains in the soil with evidence of activity over a long period.
CL029-009137-	Inishcaltra or Holy Island	House - medieval	569822E, 685018N	Situated c. 28m SSW of the round tower (CL029-009014-) on Inis Cealtra. Traces of a round house (diam. c. 10m) were excavated in 1974 (de Paor 2013, 40, 58). The house was divided internally by straight partitions, had a central hearth, and also had a projecting porch at SW. According to de Paor (ibid.) the house 'was not built with posts dug into the ground: there was an outer tegument which showed as a dark brown stain, with some wattle-holes, as from the light base timbers of a wattle or boarded structure, and within this slot, which defined the shape of the building, there were traces of massive posts (perhaps of 30cm diam.) which were not sunk in the earth but rested on pads of some kind.' A hoard of 21 very worn early Norman coins were found underneath the hearth. One coin was of Stephen (1135-1154) and the others were of Henry II (1154-1189).
CL029-009138-	Inishcaltra or Holy Island	House - medieval	569812E, 685028N	Situated c. 25m SW of the round tower (CL029-009014-) and c. 3m N of a fenced enclosure (CL029-009136-) on Inis Cealtra. Traces of an oval house (diam. c. 10m) were excavated in 1974 (de Paor 2013, 40, 58). A house of similar size (CL029-009137-) was excavated within the fenced enclosure.
CL029-009139-	Inishcaltra or Holy Island	Church	569809E, 685044N	Situated c. 18m WSW of the round tower on Inis Cealtra. An earthen church was excavated here in 1974 (de Paor 2013, 40-41, 58). A rectangular building, rebuilt a number of times on slightly different orientations. The earliest phase of building (5.5m x 4.1m) was orientated exactly the same as St. Brigid's church (CL029-009006-) and had a trodden clay floor. The walls (T over 2.5m) were defined by rows of wattle- or stake-holes and there was an entrance in the W wall. Close-set wattles appear to have been used as internal reinforcement. Rebuildings altered the orientation, first to almost NE-SW and then closer to E-W. This church, according to de Paor, represents the early phase of the monastery. The church was cut by a medieval house (CL029-009138-).
CL029-009140-	Inishcaltra or Holy Island	Burial	569833E, 685054N	Situated immediately NE of the round tower (CL029-009010-) and N and W of St. Caimin's church (CL029-009011-) on Inis Cealtra. Numerous burials were excavated in this area in the 1970's (de Paor 2013, 41, 58). They were shallow, with much disturbed and scattered bone.

				Although they were crowded together close to the foundations, the interments in these positions had been made after the construction of the buildings.
CL029-009141-	Inishcaltra or Holy Island	Metalworking site	569815E, 685012N	Situated c. 35m SW of the round tower (CL029-009010-) on Inis Cealtra and in the vicinity of two bullaun stones (CL029-009028- and CL029-009029-). A quantity of cupric slag and a number of pits, filled with stones at surface level were excavated here in 1977-9 by de Paor (2013, 42-3). The soil underneath both bullauns contained some slag and bones and was flecked with charcoal. A pit close to the bullauns provided a date of Cal AD 727-886 (UBA-30141) (Seaver and O'Sullivan 2015, 11-13).
CL029-009142-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the SW corner of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 4.3m from the S wall and 2.5m from the W wall. An undecorated recumbent graveslab (L 1.49m; Wth 0.71m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009143-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the SW corner of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 7.3m from the S wall and 2.7m from the W wall. An undecorated recumbent graveslab (L 1.57m; Wth 0.59m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009144-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 9.25m from the S wall and 0.8m from the W wall. An undecorated recumbent graveslab (L 0.52m; Wth 0.38m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009145-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 11.3m from the S wall and 3m from the W wall. An undecorated recumbent graveslab (L 1.64m; Wth 0.62m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009146-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 16.3m from the S wall and 2.9m from the W wall. An undecorated recumbent graveslab apparently in two pieces, the W portion (L 1.2m; Wth 0.45m) and the E portion (L 0.68m; Wth 0.42m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009147-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 17m from the S wall and 2.5m from the W wall. An undecorated recumbent graveslab (L 1.14m; Wth 0.41m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009148-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 19.75m from the S wall and 3.3m from the W wall. An undecorated recumbent graveslab (L 1.45m; Wth 0.45m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).

CL029-009149-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 20.3m from the S wall and 3m from the W wall. An undecorated recumbent graveslab (L 1.2m; Wth 0.64m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009150-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 21.5m from the S wall and 1.9m from the W wall. An undecorated recumbent graveslab (L 0.88m; Wth 0.61m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009151-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the NW quadrant of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 22.3m from the S wall and 1.9m from the W wall. An undecorated recumbent graveslab (L 1.14m; Wth 0.74m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009152-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 14.6m from the S wall and 6m from the W wall. An undecorated recumbent graveslab (L 1.5m; Wth 0.47m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009153-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the SW corner of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 1.5m E of the small kerbed enclosure containing a cross-base (CL029-009016-) and 7.7m from the S wall. An undecorated recumbent graveslab (L 1.2m; Wth 0.42m at the W end and 0.12m at the E end) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009154-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.6m from the S wall and 8.5m from the W wall. A recumbent cross-slab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). This is now completely grassed over but the outline is discernible under the sod (L 1.77m; Wth 0.42m). Drawn by de Paor (SMR file) as a broken slab with a double-line Latin cross with hollowed angles on a square base.
CL029-009155-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 13m from the S wall and 8.5m from the W wall. An undecorated recumbent graveslab (L 1.65m; Wth 0.47m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009156-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 15.9m from the S wall and 8.1m from the W wall. An undecorated recumbent graveslab (L 0.84m; Wth 0.23m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009157-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 16.4m from the S wall and 8.15m from the W wall. An undecorated and partially sod-covered recumbent

				graveslab (L 0.53m; traceable Wth 0.4m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009158-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 18.9m from the S wall and 7.6m from the W wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009159-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 19.7m from the S wall and 8.2m from the W wall. An undecorated recumbent graveslab (L 1.21m; Wth 0.48m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009160-	Inishcaltra or Holy Island	Graveslab	569866E, 685067N	A recumbent graveslab (L 1.12m; Wth 0.28m), the southernmost of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009104-, CL029-009161- and CL029-009162-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. The slab is drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009161-	Inishcaltra or Holy Island	Graveslab	569866E, 685067N	A recumbent graveslab (L 1.17m; Wth 0.28m), one of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009104-, CL029-009160- and CL029-009162-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. The slab is drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). This may be a reused architectural fragment as there is incised rope moulding running along the N side of the slab. A second smaller stone to the W has similar moulding but is not recorded as a graveslab by Macalister.
CL029-009162-	Inishcaltra or Holy Island	Graveslab	569866E, 685067N	A recumbent graveslab (L 2.06m; Wth 0.57m), one of four slabs on the floor of 'Teampul na bhFear nGonta' (CL029-009015-) (see also CL029-009104-, CL029-009160- and CL029-009161-) in the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. The slab is drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV) and is broken into three pieces.
CL029-009163-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 18m from the S wall and 9.9m from the W wall. An undecorated recumbent graveslab (L 1.46m; Wth 0.51m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009164-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.55m from the N wall and 11.45m from the E wall. A recumbent graveslab (L 0.98m; Wth at top 0.74m; Wth at base 0.65m) drawn but not numbered on Macalister's plan of the graveyard (1916-

				17, pl. XV). An incised line extends E-W 0.11m in from the straight N edge but the stone is otherwise undecorated.
CL029-009165-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 11.25m from the N wall and 11.45m from the E wall. An undecorated, uneven, recumbent graveslab (L 1.2m E-W; Wth 0.49m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009166-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 10.65m from the N wall and 11.6m from the E wall. An undecorated, uneven, recumbent graveslab (L 1.13m E-W; Wth 0.42m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009167-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) and 8.69m from the N wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. An undecorated graveslab (L 1.02m E-W; Wth 0.4m), broken in two.
CL029-009168-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) and 8.18m from the N wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A graveslab (L 1.27m E-W; Wth 0.46m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). Although this slab is not numbered or described by Macalister it has a deeply incised single-line cross running the length of the slab. The cross has hollowed angles and the shaft is open-ended. Portion of the top of the cross is grassed-over.
CL029-009169-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) and 6.98m from the N wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. A graveslab (L 0.6m E-W; Wth 0.46m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). Although not numbered or described by Macalister, this slab has a cross in relief with hollowed angles and expanded and squared terminals.
CL029-009170-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra and 5.98m from the N wall of the graveyard. A recumbent graveslab (L 0.73m; Wth 0.38m) indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). De Paor depicts the faint outline of a carved wheeled cross with ornamentation consisting of small crosses on one side of the shaft (drawing, SMR file); due to weathering it is unclear whether de Paor's drawing

				refers to this slab, an adjacent one (CL029-009171-) or indeed one that may now be completely overgrown.
CL029-009171-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra and 5.57m from the N wall of the graveyard. A recumbent graveslab (L 0.59m E-W; Wth 0.25m) with a rough and uneven surface indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). De Paor depicts the faint outline of a carved wheeled cross with ornamentation consisting of small crosses on one side of the shaft (drawing, SMR file); due to weathering it is unclear whether de Paor's drawing refers to this slab, an adjacent one (CL029-009170-) or indeed one that may now be completely overgrown.
CL029-009172-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated immediately outside the E wall of Teampul na bhFear nGonta (CL029-009015-) within the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra and 4.8m from the N wall of the graveyard. A rough, uneven, recumbent graveslab (L 1.14m E-W; Wth 0.44m at the top; Wth 0.4m at the base) indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). A slab of similar length but only c. 0.12m wide lies immediately to the N, similar to the kerbstones around the composite grave (CL029-009210-) adjacent to the E.
CL029-009173-	Inishcaltra or Holy Island	Graveslab	569876E, 685069N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 3.3m from the E wall of Teampul na bhFear nGonta (CL029-009015-) and 2.05m from the N wall of the graveyard. A narrow slab (L 1.35m E-W; Wth at top 0.12m; Wth at base 0.1m) forming the N edge of a composite grave (CL029-009210-). The slab is drawn as a wider, undecorated and unnumbered slab on Macalister's plan of the graveyard (1916-17, pl. XV). An inscription at the W end reads '+ OR DO THRESSACH +' with a cross at the beginning and the end. At least one of the S's is reversed. A mortise-like hollow on the S face of the slab at the E end may be related to the construction of the composite grave. (Tunney and Manning 2015, 42-3)
CL029-009174-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the SE corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 4.7m from the E wall and 6.34m from the S wall. A plain, uneven graveslab (L 1.25m; Wth, 0.66m) indicated as plain and not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009175-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	This record is for the original location of an undecorated graveslab depicted but not numbered on Macalister's plan of the 'Saint's graveyard' (CL029-009030-) (1916-17, pl. XV)

				close to the centre. The slab is no longer evident at this location and its present location is unknown.
CL029-009176-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.55m from the N wall and 6.05m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab has an uneven surface and is broken in two with a diagonal break across the centre.
CL029-009177-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 6.1m from the N wall and 6.16m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab (L 0.81m; Wth 0.39m) has an uneven surface and is partially grassed over.
CL029-009178-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 14.08m from the N wall and 4.06m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab (L 1.27m; Wth 0.52m) has an uneven surface.
CL029-009179-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 13.45m from the N wall and 4.06m from the E wall. An undecorated recumbent graveslab drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab (L 1.04m; Wth 0.42m) has an uneven surface.
CL029-009180-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the Saint's graveyard (CL029-009030-) on Inis Cealtra, 12.63m from the N wall and 2m from the E wall. An undecorated recumbent graveslab (L1.42m; Wth at top 0.48m; Wth lower third 0.23m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab has a rough uneven surface.
CL029-009181-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	This record is for the original location of an undecorated graveslab depicted but not numbered on Macalister's plan of the 'Saint's graveyard' (CL029-009030-) (1916-17, pl. XV) close to the E wall. The slab is no longer evident at this location and its present location is unknown.
CL029-009182-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 8.46m from the N wall and 2.2m from the E wall. An undecorated recumbent graveslab (L1.56m; Wth 0.49m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). The slab is uneven has natural striations on the surface.

CL029-009183-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the NE corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 7.9m from the N wall and 2.2m from the E wall. An undecorated recumbent graveslab (L1.2m; Wth 0.55m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009184-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the NE corner of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 7.25m from the N wall and 2.2m from the E wall. An recumbent graveslab (L1.34m; Wth 0.5m) drawn but not numbered on Macalister's plan of the graveyard (1916-17, pl. XV). There is an oval quartz inclusion towards the bottom of the slab but it is otherwise undecorated.
CL029-009185-	Inishcaltra or Holy Island	Cross-inscribed stone	569854E, 685099N	Situated in the OPW chalet on Inis Cealtra. A rough sandstone block (H 0.24m; Wth 0.21m; T 0.06m) with a single-lined incised Latin cross with very slightly expanded terminals placed centrally.
CL029-009186-	Inishcaltra or Holy Island	Cross	569854E, 685099N	Situated in the OPW chalet on Inis Cealtra. A trapezoidal-shaped stone (max. L 0.25m; Wth 0.19m; T 0.05m) with a shallow rectangular slot (0.09m x 0.05m; D 0.01m) centrally placed. The sides of the socket are angled.
CL029-009187-	Inishcaltra or Holy Island	Penitential station	569793E, 685050N	Situated 33m W of the round tower (CL029-009010-) on Inis Cealtra. A grass-covered subrectangular mound of earth and stones (2.8m N-S; 2m E-W; max. H at S 0.45m). An earthfast slab (L 0.4m; H 0.2m; T 0.7m) at NW may have been a kerbstone. A second earthfast stone at SE (Wth 0.3m; H 0.3m; T 0.12m) is falling or pushed outwards and may also have served as a kerbstone. Mentioned in the OS Letters for County Galway (O'Flanagan 1927, vol. 2, 227-8) as forming part of a pattern held on the island.
CL029-009188-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the W half of the 'Saint's graveyard' (CL029-009030-) in a row of graveslabs (between CL029-009089- (Macalister no. 53) and CL029-009110- (Macalister no. 75)), 14.9m from the W wall of the graveyard and 7.8m from the W wall. This tapering limestone slab (L 1.28m; Wth at W 0.42m; Wth at E 0.22m) has no decoration or inscription and is not illustrated in Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009189-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated towards the centre of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra, 14.1m from the S wall and 10.7m from the W wall. An undecorated limestone slab (L 1.5m; Wth 0.43m) not recorded on Macalister's plan of the graveyard (1916-17, pl. XV).
CL029-009190-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated inside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra to the S of the entrance. The southernmost in a row of four small undecorated graveslabs (see CL029-009144-, CL029-009191- and CL029-009192-). Only CL029-009144- is illustrated on

				Macalister's plan of the graveyard (1916-17, pl. XV). This slab (L 0.9m E-W; Wth 0.47m) is 7.7m from the S wall and 0.9m from the W wall of the graveyard.
CL029-009191-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated inside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra to the S of the entrance. One of four small undecorated graveslabs in a row (see CL029-009144-, CL029-009190- and CL029-009192-). Only CL029-009144- is illustrated on Macalister's plan of the graveyard (1916-17, pl. XV). This slab (L 0.68m E-W; Wth 0.53m) is 8.3m from the S wall and 0.9m from the W wall of the graveyard and appears to be in two pieces.
CL029-009192-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated inside the W wall of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra to the S of the entrance. One of four small undecorated graveslabs in a row (see CL029-009144-, CL029-009190- and CL029-009191-). Only CL029-009144- is illustrated on Macalister's plan of the graveyard (1916-17, pl. XV). This slab (L 0.83m E-W; Wth 0.46m) is 8.8m from the S wall and 0.9m from the W wall of the graveyard.
CL029-009193-	Inishcaltra or Holy Island	Cross-slab	569872E, 685057N	Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. This slab (L 1.65m; Wth 0.58m) is not depicted on Macalister's plan of the graveyard (1916-17, pl. XV) but it lies between his no. 46 (CL029-009082-) and no. 51 (CL029-009087-), 12.2m from the N wall and 4.06m from the E wall of the graveyard. There is an incised single-line cross near the edge of the slab at the W end. The line of the arms of the cross is not quite at right-angles to the shaft. (De Paor, drawing, SMR file)
CL029-009194-	Inishcaltra or Holy Island	Graveslab	569872E, 685057N	Situated in the E half of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra. This slab (L 0.69m; Wth 0.49m) is not depicted on Macalister's plan of the graveyard (1916-17, pl. XV) but it lies immediately W of his no. 64 (CL029-009099-), 11.65m from the N wall and 3.1m from the E wall of the graveyard. The slab is irregularly shaped and has a rough uneven surface.
CL029-009195-	Inishcaltra or Holy Island	Cross-inscribed stone	569860E, 685051N	Situated in the graveyard (CL029-009012-) S of St. Caimin's church (CL029-009011-) on Inis Cealtra, 4m S of the doorway linking this graveyard and the 'Saint's graveyard' (CL029-009030-). An erect earthfast stone aligned N-S (H 0.84m; T 0.15; Wth at base 0.64m shouldered at the sides and narrowing to 0.34m at the top). The top of the stone is broken off. The W face has a central vertical carving (Wth 0.025m) comprising a rib flanked on each side by an incised line. The line extends 0.44m down from the broken top of the stone and may represent a cross shaft. Compiled by: Mary Tunney Date of upload: 17 November 2015

CL029-009196-	Inishcaltra or Holy Island	Cross-inscribed stone	569845E, 685062N	Situated on the floor along the N wall of the nave of St. Caimin's church (CL029-009011-). A fragment of a cross-inscribed sandstone slab (H 0.22m; Wth 0.21m; T 0.05m) with one curved edge. It may originally have been subcircular. A simple single-lined equal-armed cross appears to be central to the original shape of the slab.
CL029-009198-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Mounted in an inverted position against the S wall of the nave of St. Caimin's church (CL029-009011-) on Inis Cealtra and 2.88m from the E end. A cross-slab (H 0.51m; Wth 0.33m; T 0.06m) found during excavations in 1970-72. The slab bears an outline Latin cross with square expanded terminals and a square at the centre enclosed in a double-lined frame. The text, in two lines in the upper quadrant reads 'FLA[ITH] BERTACH'. The same name occurs on another cross-slab (CL029-009088-) in St. Caimin's church. (Okasha and Forsyth 2001, 99-101)
CL029-009199-	Inishcaltra or Holy Island	Cross	569846E, 685056N	Situated against the S wall of the nave of St. Caimin's church (CL029-009011-) and 2m from the E end. A fragment of a possible cross-shaft (H 0.32m; Wth 0.29m) with a roll-moulding at one edge. Although uncertain this may be a portion of a fragment of a cross (CL029-009114-) described and illustrated by Macalister (1916-17, 161, no. 79). (De Paor, drawing, SMR file)
CL029-009200-	Inishcaltra or Holy Island	Cross-slab	569846E, 685056N	Situated against the S wall of the nave of St. Caimin's church (CL029-009011-) and 4.4m from the E end. A subrectangular fragment of a sandstone cross-slab (max. Wth 0.26m; H 0.17m; T 0.05m) showing the top portion of an incised wheeled cross.
CL029-009201-	Inishcaltra or Holy Island	Cross	569845E, 685062N	Located near the W gable wall of St. Caimin's church (CL029-009011-) just N of the doorway. A possible cross-base (originally in the Saint's Graveyard, see Macalister (1916-17, pl. XV, close to 38(26)) comprising a subcircular, sandstone, flat-topped block (0.32m x 0.3m) with a circular, flat-bottomed socket (diam. 0.08m; D 0.05m) inside a carved circle. Two opposing radial lines extend from the socket to the circle. Macalister (ibid., 152) notes that this may have been a door-socket.
CL029-009202-	Inishcaltra or Holy Island	Cross-slab	569782E, 684916N	Situated against the N wall of the nave of St. Mary's church (CL029-009008-) and 5.44m from the W gable. Part of a cross-slab (H 0.61m; Wth 0.44m; T 0.09m) with two incised parallel lines 0.08m apart off-centre and at an angle, veering towards the edge of the slab.
CL029-009203-	Inishcaltra or Holy Island	Cross	569854E, 685099N	Situated in the OPW chalet on Inis Cealtra. The base of a cross, comprising a subcircular boulder (0.35m x 0.37m) with a rectangular socket (0.15m x 0.07m; D 0.03m).

CL029-009208-	Inishcaltra or Holy Island	Penitential station	569854E, 685077N	Situated on fairly level ground c. 15m N of St. Caimin's church (CL029-009011-) on Inis Cealtra. A subcircular, grass-covered mound with a flattish top (4.6m E-W; 4.15m N-S; Wth across top 0.9-1.3m). A stone (L 0.34m) set along the perimeter at NE may have been a revetting stone. A second stone (L 0.3m) at S is set perpendicular to the mound. According to the OS Letters (O'Flanagan 1927, vol. 2, 228) pilgrims went round a station monument at the 'end of St. Caimin's church'.
CL029-009209-	Inishcaltra or Holy Island	Pillar stone	569851E, 685033N	Lying loose against the W wall of St. Caimin's graveyard (CL029-009012-) on Inis Cealtra. A tall, slightly tapering stone with a sloping top (L 1.12m; Wth at base 0.12m; Wth in middle 0.2m; Wth at top 0.16m; T 0.14 at base and 0.12m at the top). The lowest 0.2m is rough and may have been under ground. One face is worked smooth and flat with 5 small depressions (diam. 0.02m (smallest) to 0.04m (largest)), some circular and some oval, arranged in serpentine fashion 0.34-0.5m up from the base. No other markings are evident. The precise original location of this stone is unknown.
CL029-009210-	Inishcaltra or Holy Island	Graveslab	569876E, 685069N	Situated in the E half of the 'Saint's Graveyard' (CL029-009030-) on Inis Cealtra and 3.3m from the E wall of Teampul na bhfear ngonta (CL029-009015-). A composite grave of recumbent slabs separated and framed by a series of kerb-like slabs, two at the top, five along the base and one at north. A continuity of the eastern kerb is suggested by the presence of a single thin slab protruding above ground level. There were originally at least five slabs. Two of the remaining slabs are cross-slabs (CL029-009095- and CL029-009094-) and two have inscriptions (CL029-009068- and CL029-009173-). A mortise-like depression on the S face of the most northerly kerbstone may have functioned as a slot into which the adjoining eastern kerbstone fitted at this corner. (Okasha and Forsyth 2001, 64; Tunney and Manning 2015, 42-3)
CL029-009212-	Inishcaltra or Holy Island	Cross	569872E, 685057N	Situated in the NE quadrant of the 'Saint's graveyard' (CL029-009030-) on Inis Cealtra at the head of a cross-slab (CL029-009070-). A long, low, socketed stone (L 1.01m; average Wth 0.14m; H 0.18m) oriented N-S. The socket (int. L 0.19m; Wth 0.09m; D 0.06-0.07m) is 0.18m from the S end of the stone and 0.56m from the N end.
CL029-009213-	Inishcaltra or Holy Island	Graveslab	569783E, 684908N	Situated c. 0.88m outside the S wall of St. Mary's Church (CL029-009008-) on Inis Cealtra. A large recumbent sandstone graveslab (L 1.37m; Wth 0.45m) with a straight W side and

				uneven shape elsewhere. The surface of the slab is also very uneven and has a 'humped' shape and no visible markings. It is not clear that this is an early graveslab.
CL029-009214-	Inishcaltra or Holy Island	Excavation - miscellaneous	569815E, 685060N	Situated N of the round tower (CL029-009010-) on Inis Cealtra. Excavations took place in this area (licence no. E000180) in the 1970s (de Paor 2013). Post excavation work in 2015 resulted in a radiocarbon date of Cal AD 551-639 (UBA-30514) from a 'trench' or ditch showing the presence of features dating from the reputed foundation of the ecclesiastical site. (de Paor 2013, 58; Seaver and O'Sullivan 2015, 11-13)
CL029-009215-	Inishcaltra or Holy Island	Burial	569824E, 685059N	Situated c. 9m NW of the round tower (CL029-009010-) on Inis Cealtra. Excavations in the 1970s (licence no. E000180) revealed burials in this area (de Paor 2013), possibly linked to the earthen church (CL029-009139-). Post-excavation work in 2015 yielded radiocarbon dates of Cal AD 777-992 (UBA-27100) and Cal AD 725-979 (UBA-27101). (Seaver and O'Sullivan 2015, 11-13, 34)
CL029-009216-	Inishcaltra or Holy Island	Burial	569743E, 685121N	Situated in the fosse of the D-shaped enclosure (CL029-009) around St Michael's Church (CL029-009) on Inis Cealtra. Excavations in the 1970s (licence no. E000180) revealed a burial cut into the fosse of the enclosure. Post-excavation work in 2015 yielded a radiocarbon date range of Cal AD 1024-1163 (UBA-30142). The burial is possibly of a female aged 25-35. (Seaver and O'Sullivan 2015, 11-14, 35)

9.2 Previous Archaeological Investigations (excavations.ie)

Location: Inishcaltra (Holy Island),

Licence: -

Date: 1970

Name: Liam De Paor, Department of Modern History, UCD

ITM: 569757E, 685037N

Summary:

As part of a long-term project of excavation, work was begun in 1970 on the monastic site of Holy Island, or Inis Cealtra, Co. Clare. The island, of more than forty acres, is in Lough Derg, about a quarter of a mile from the western shore of the Shannon near Mountshannon. Here there are ruins of stone churches, a round tower, remains of stone crosses and grave-slabs, and an extensive system of enclosures and paths or roadways defined by earthworks. Most of the remains clearly visible on the ground are concentrated on the western half of the island, but air photographs show that some of the earthworks extended to the east as well. The site has been fully described by Macalister (P.R.I.A. C 1916-17, pp. 93ff.).

Excavation in the first season was commenced at three sites on the island:

- (1) The church known as the "Baptism Church" (O.S.) or "St. Brigid's Church" (Macalister);
- (2) The "Holy Well" (Macalister) or "Lady Well" (O.S.);
- (3) The "Cottage".

The Baptism church is a ruin of a small single-celled building with a carved Romanesque doorway which, together with the whole of the west gable, was re-erected by the Board of Works in the last century. There was also a round-headed window in the east wall when the Ordnance Survey visited the island, but most of the east wall subsequently fell. The church stands inside an enclosure bounded on the south by the lower part of a well-built masonry wall pierced with a round-arched gateway. On the other three sides the enclosure before excavation was marked by banks, at least partly of earth, in which some stone showed.

Excavation showed that the enclosure was free of burials. Collapsed masonry from the church was found on all sides, including the more or less intact east gable under a light turf. The enclosure boundary proved to be complex, and at the close of the 1970 season it seemed that the enclosure resulted in part at least from the adaptation of pre-existing features, part of the system of "field

enclosures" which extends over a large part of the island. The denuded earthen banks which define this system are, in this area at least, associated with deep v-ditches. Finds from the lower silt-like fill of these ditches included an openwork bronze brooch with animal ornament in Lindisfarne style and no objects which could be given an appreciably later date. The church enclosure proper, which was fitted into the corner of one of the "field enclosures" had several stages, the last of which, a crude drystone wall, may be of late medieval date. An earlier stage was marked by a ditch, filled largely with food refuse (much animal bone) which was associated with a rich occupation deposit to the north of the church. Bronze pins and other objects of twelfth- and thirteenth-century date came from the deposit. What appeared to be an earlier stage of enclosure was marked by the remains of an earthen bank.

The mortared stone wall bounding the enclosure to the south was at both terminals returned briefly to the north, where the unmortared and poorly built cashel wall bounding the west, north and east sides joined it. This south wall appears to be associated with St. Mary's church (lying to the south of St. Brigid's) and is probably of thirteenth-century date.

The area to the west of the church, both inside and outside the enclosure, was one of industrial activity of several kinds. Part of a bronze working furnace was found, and also remains of iron-reduction pits. There was an area in which roofing slates were trimmed. Outside the enclosure to the west, working pits were numerous. Two complete decorated quern-stones (almost identical in design) were found, as well as one broken in course of manufacture.

A hollow-based barbed flint arrowhead and a small polished stone axe were found in the area north of the church and indicate that there had been some Early Bronze Age activity in the vicinity.

Several fragments of Romanesque sculpture of a high quality were found in secondary position. These do not belong to any of the architectural features now remaining on the island. It is possible that Inis Cealtra was a centre of production for twelfth-century carved work, perhaps for churches along the Shannon.

The interior of the church had been used at some relatively late date for burials. These, however, were sealed by several phases of dilapidation and by the small occupation deposit which marked the herd's shelter recorded as having occupied the east end of the church in the early nineteenth century. From evidence found with two of the skeletons it would seem that this was a specialised birth place, for women dying in childbirth.

Excavation at St. Brigid's was suspended at the end of the season and it is hoped to complete it in 1971.

The well was pumped dry and excavated. An area around it was also excavated. It was found that a paving of gravel had been laid down around the well, and that a drain had been constructed to keep this area dry. There was abundant evidence of a cult of offerings, mainly coins and small objects. These dated from c.1850 onwards, the greater part of them from the early twentieth century.

The interior of the “cottage” was excavated, together with an area around it. This, a two-roomed building with back-to-back fireplace, had been constructed without foundations, the base-courses of the walls being laid directly on the turf. No floor remained in the interior, possibly as a result of the “clearing out” undertaken by the Board of Works in 1870. It was clear however that the floor of the building had sloped sharply. Finds were few—fragments of iron objects—and not closely datable.

Location: Inishcaltra (Holy Island)

Licence: -

Date: 1971

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569757E, 685038N

Summary:

Work on Inishcaltra, in an eleven-week season in 1971, was concentrated on the site of the Baptism Church, which had also been the main centre of excavation in 1970.

Excavation of the area within the church enclosure was completed, and confirmed that the enclosure was free of burials. Excavation of the church itself was completed, and it was found that a number of persons (about twenty) had been interred within the building. Two of the burials were of women in childbirth. Others however were of adult males or immature persons. The burials were examined in situ by Dr. Eamon de Valera and Dr. Maire de Valera. Finds with the burials included iron nails and coffin handles, part of a bone pin (for a shroud?) and a bronze mounting, which appears to have been attached to an arinlet of organic material on the upper arm of one of the burials. This had ornament

of late-twelfth or early thirteenth-century character. This date is consistent with the character of the other objects. There is a probability that the burials date from around 1200.

It is suggested that the little Baptism Church, erected c. 1150 (stylistic dating) was abandoned perhaps as soon as half-a-century afterwards, or even less, and replaced by the larger St. Mary's Church. This abandonment probably marks the end of the monastery of Inis Cealtra, although the island clearly continued to be an ecclesiastical site.

Four stages were distinguished in the construction of the enclosure, the latest, represented by a drystone wall, being late medieval or early modern in date. A system of paved paths, associated with this wall, was connected with St. Mary's Church, and appears to date from the period of patterns and pilgrimages in the 17th or 18th century.

More evidence was found of the industrial activity, observed in 1970. As well as stone-working, bronze-working and iron-working, it was found that bone combs were being manufactured in the vicinity. This activity appears to have taken place in the late twelfth and in the thirteenth century. A very large cesspit was excavated to the north of the enclosure. There were no habitations in the area excavated.

Excavation at this site is now all but complete. It is hoped to complete it early in the 1972 season and proceed with conservation at the Baptism Church and with excavation of banks and enclosures to the north of it.

Location: Inishcaltra

Licence: -

Date: 1972

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569757E, 685038N

Summary:

Work on Inishcaltra was begun in 1970, and continued in 1971 and 1972. In the first two seasons the main centre of activity had been the site of the Baptism Church (Site 1). Work was concluded here in 1972, and site conservation was carried out. This included restoration of the stone wall which formed the latest phase of enclosure of the church site. The 13th century mortared wall which formed the boundary to the S. was flanché and pointed, and where necessary brought up in new masonry to a

height sufficient to provide protection against cattle. The dry-built wall which had bounded the site to the W., N. and E. in the last, Late Medieval, phase of construction, was wholly rebuilt and restored, with a mortar-filled core, and was brought up to a height sufficient to keep cattle out. Mortar was used because the original work was of such poor quality that a faithful restoration would have been neither durable nor effective. The barbed wire fence has now been removed from around this monument.

Site 4: “St Michael’s Church”: Work was commenced in 1972 on the site variously described as “St Michael’s” or “Garraidh Mhichil”. Here there is a D-shaped enclosure around the summit of the island, forming a focus for the Inishcaltra system of earthworks. Near the centre of the D was a smaller enclosure (just under 15m in maximum dimension or plan) marked before excavation by a low stony bank. It proved to be roughly square and to have two phases of construction. In the first it was defined by an earthen bank with an external ditch. An unmortared stone wall had been added, on the crest or inner slope of the bank. Some remains of stone paving were found running along the inside of the wall.

The enclosure had been used as a burial ground, exclusively for children apparently ranging in age from a year or two up to adolescence (expert opinion is not yet available). A very small (2.5m externally) mortared stone structure with a W. doorway had been constructed in the centre of the enclosure at some stage after burial had commenced. Finds of coins and other objects suggested that the main period of activity here was in the chronological range c. AD 1500–1800. Work continues at Site 4, and it is hoped in 1973 to expand to investigate the larger, D-shaped enclosure. The stone wall, paving and small building are tentatively interpreted as remains of the development of sites on the island as cult-centres for the great annual pilgrimage known to have been a feature of the seventeenth and eighteenth centuries.

Site 5: “Anchorite’s Cell”: Work was also commenced in 1972 around the small structure of unknown purpose which has been speculatively described as a “confessional” or “anchorite’s cell”. This too stood in a small enclosure defined by a drystone wall, with traces of paving along its inner base. Excavation is at an early stage in this area (“Site 5”), but at least three phases of activity can be discerned. The first may be pre-Viking, and probably included burial and the erection of a stone cross. The second has yielded material, including strips of bronze with engraved ornament in Kingerike style, apparently of eleventh century date. The third, which probably included both the enclosing wall and the “anchorite’s cell” in its present form, is being interpreted tentatively as further evidence of the development of cult-sites on the island in connection with pilgrimage, at a date which may be as late as the beginning of the eighteenth century.

It is hoped to continue work at Site 5 in 1973.

Location: Inishcaltra (Holy Island)

Licence: -

Date: 1973

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569616E, 685015N

Summary:

In a short season in 1973, work was continued on two sites begun in 1972.

Site 4: The site described in published accounts as “St Michael’s” at the highest point of the island was further investigated. The burials exposed in 1972 were examined in situ by Dr Maire Delaney. They were found to be mainly of recently born infants. It had been customary to deposit in each infant grave a handful of quartz pebbles and a long stone pebble (sometimes a whetstone, sometimes a shaped stone of phallic appearance). The small square building, of which the base courses remained in the centre of the enclosure

Site 5: In the enclosure around the “penitential cell” occupation deposits were examined. The enclosing wall, of modern date, was removed, and under layers of occupation material of 11th-12th century date, traces of timber structures were exposed, as well as pits. Some burials, not yet excavated, underly these remains in turn. The “penitential cell” was shown by excavation around and under its foundations to be modern in date, and will be removed when excavation continues in 1974. Immediately to the west of it, traces were found of a squarish small timber structure of comparable size. It is for the moment assumed, on the evidence so far available, that the “penitential cell” represents the last rebuilding, c. 1700, of a possibly ancient structure- probably a shrine.

Site 6: A wide cutting was run down the hill-slope between sites 4 and 5, cutting across the boundaries of two of the larger enclosures. Excavation is continuing.

Location: Inis Cealtra (Holy Island)

Licence: -

Date: 1974

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569617E, 685014N

Summary:

In the 1974 season work at Inis Cealtra proceeded with the greatest difficulty, because of appalling weather.

Site 5: Investigation continued of the area around the "Confessional", where cuttings were extended. The "Confessional" itself, after a stone-by-stone survey, was taken apart and the stones numbered for reconstruction. In the demolition it became clearer that the inner sub-megalithic structure antedated the outer, mortared, building. Under the cist-like base of this inner structure was found a small deposit of bones, some human but mainly animal. The whole building had been constructed on a podium of flagstones, and remains of two earlier such platforms were found underneath this. A wooden structure of still earlier date, traces of which were observed in 1973 just to the west of the stone building, has been interpreted as a first version of the "Confessional" which, as O'Donovan suggested, was probably a tomb-reliquary.

Occupation deposits had been observed in the area immediately to the north of the "Confessional", in two phases (probably eleventh century and twelfth-thirteenth century). As the cuttings were extended northwards, the occupation material faded out giving way to evidence for (later medieval?) cultivation. The traces of a small circular hut, with central hearth, of very flimsy construction (probably resembling an upturned basket) appeared to be associated with waste from eleventh-century bronze-working. Burials, which antedated the activity described above, were located on Site 5, but because of the adverse weather conditions, examination of them was deferred.

Site 6: Excavation was concluded on a broad Sondage designed to examine the slope between Site 5 and Site 4 ("St Michael's"), crossing boundaries of some of the small enclosures. No evidence of permanent occupation was found, but much of occasional activity, with numerous pits and work-areas. The small enclosures, prominent on the surface in this area, were of late date.

Site 7: A new area of investigation was opened around St. Caimin's Church and the Round Tower. This had been a burial area and many of the burials antedated the two stone buildings. There was also much evidence for nearby occupation and intensive casual activity, or at least frequentation of the site. The evidence included some sherds of E2 ware. Work here was much impeded by the weather and is still at an early stage.

The doorway of St. Caimin's Church, rebuilt by the Board of Works in 1879-80, was taken down for re-examination. In that reconstruction, three voussoirs with human masks had been set as keystones for the three orders of the arch. Seven such voussoirs have now been assembled. They appear to be part of an arch-ring like that of Dysert O'Dea, or Inchagoill (with which O'Donovan, examining the collapsed remains of the doorway in 1838-39, compared St. Caimin's). The area immediately around the doorway is being examined, partly with the hope of finding more voussoirs. Detailed stone-by stone survey was completed before demolition, both by measurement and by photography.

Location: Inis Cealtra (Holy Island)

Licence: -

Date: 1975

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569757E, 685038N

Summary:

A very short season was worked in 1975, in which attention was concentrated on Site 5- the area to the N of St. Caimin's Church and the Saints' Graveyard.

In this area, traces were found of a rectangular fenced enclosure (probably a wicker fence) around the small structure known as the "Confessional" or the "Anchorite's Cell". This structure, thought to be a shrine, had been repeatedly rebuilt. Traces of cultivation (probably medieval) extended to the western and northern limits of this enclosure.

Close by to the N traces were found of a round enclosure, similarly fenced. At least one small round hut was within the enclosure, which is interpreted as monastic at this stage.

Scattered burials in the area—not yet investigated—antedated both enclosures. Finds included whetstones, decorated quern fragments, a fragment of grave-slab with triquetra knot and spiral ornament, some amphora sherds from the drift surface, and late glass and pottery sherds.

The evidence from this site is provisionally being interpreted as indicating a monastic re-settlement of Inis Cealtra, about the time of Brian Boroimhe, probably after an interval (since the early ninth

century?) in which the island was not occupied. Both the earlier and the later occupations appeared to have been on a small scale.

Work was continued on the doorway of St. Caimin's, taken down in 1974. This appears to have been of four, not three, orders, and reassembly was tested in a sandpit after careful and detailed measurement of all available voussoirs.

Location: Inis Cealtra (Holy island)

Licence: -

Date: 1976

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569757E, 685937N

Summary:

No report received.

Location: Inis Cealtra

Licence: -

Date: 1980–84

Name: Liam de Paor, Department of Modern History, UCD

ITM: 569617E, 685015N

Summary:

No report received.

APPENDIX 14.6

OLD RECTORY MOUNTSHANNON, ARCHAEOLOGICAL IMPACT ASSESSMENT



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024



**Proposed Development at the Old Rectory, Mountshannon, County
Clare**

Archaeological Impact Assessment

On behalf of Clare County Council

**Claire Walsh
Updated April 2023**

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Introduction

This report details the potential impact of upgrading an early 20th century building known as 'the Old Rectory', Mountshannon, County Clare, for use as an exhibition, educational and enterprise centre community/co-working space. The conclusions of the impact of the development on the archaeological resource are negative. However it is advisable that archaeological monitoring is undertaken on the site.

Description of the proposed development

Alterations, modifications and change of use of the existing Old Rectory, Mountshannon (a Protected Structure, RPS No. 464) from Residential to Tourism Interpretive Centre and Café uses, on a site measuring 1.35ha in the Townland of Mountshannon, consisting of:

- i. Demolition of the existing outbuildings (157 sq.m) to the north-east of the site;
- ii. Construction of a 57sq.m single-storey ground floor extension to the north-west of the building (double height space) with a maximum height of 6.4m (and lift height 7.8m) above ground level and new internal stair access;
- iii. At ground floor level, exhibition and educational spaces, together with supporting uses including a reception area, welfare facilities and plant room;
- iv. At first floor level, a café, ancillary retail and office spaces, together with welfare facilities and storage areas;
- v. A new lift within the footprint of the existing building to provide for universal access to first floor level;
- vi. At ground floor level, a new opening in the northern and western wall of the existing building to provide access to the proposed extension, new and enlarged openings to internal walls between the existing kitchen and utility room, new openings between the existing hallway and lounge, and removal of the wall between the existing WC and office and between the existing kitchen and hallway;
- vii. At first floor level, new openings and removal of internal partitions, together with an opening in the roof to provide access to the lift and a new opening in the northern wall at first floor level to provide access to the cafe;
- viii. Cleaning and repointing works to the existing brickwork, repair and replacement of any damaged roof slates with natural slate, replacement of PVC windows with double- glazed timber sash windows and the removal of modern internal additions (flooring and cornices);
- ix. Resurfacing of the existing internal vehicular access road and construction of a new vehicle passing bay along the existing internal access road;
- x. Provision of 2 new dedicated pedestrian access points from Harbour Road including 1 at the existing site entrance and 1 to the south-west of the site, together with construction of a 1.8m wide pedestrian footpath to the west of the existing internal vehicular access road and a new public footpath to the south of the Old Rectory site with a new pedestrian crossing connecting to the existing path to the south of Harbour Road;
- xi. Provision of a new pedestrian connection to Aistear Park to the west of the site;
- xii. Regrading existing levels to the front (south side) of the building to achieve universal access consistent with Part M of the Building Regulations;

- xiii. Provision of 12 car parking spaces (inclusive of 2 disabled access spaces and 2 EV charging points), to the north and east of the building and inclusion of 1 set down space to the east of the building;
- xiv. Provision of 20 secure bicycle parking spaces for visitors;
- xv. Construction of ancillary structures comprising a 15sq.m single-storey maintenance shed (with a maximum height of 3.246m) to the north of the site, a semi-covered seating area to the west of the Old Rectory building, and a 6sq.m ESB Unit Substation (2.2m in height) to the north-east of the Old Rectory building; and
- xvi. All ancillary site works including public lighting, landscaping, drainage, connections to public services and undergrounding of an existing ESB overhead line.
a pedestrian connection to Aistear Park;
- xv. Regrading existing levels to the front (south side) of the building to achieve universal access consistent with Part M of the Building Regulations;
- xvi. Provision of 12 total car parking spaces (inclusive of 2 disabled access spaces and 2 dual EV charging points), to the north and east of the building and inclusion of 1 set down space to the east of the building;
- xvii. Provision of 20 secure bicycle parking spaces for visitors including 10 covered spaces at the north-east of the building and 10 uncovered spaces at the south-east of the building;
- xviii. Construction of ancillary structures on the site comprising a maintenance shed to the north of the site, a semi-covered seating area to the west of the Old Rectory building, and ESB Unit Substation to the north-east of the Old Rectory building; and
- xix. All ancillary site works including public lighting, landscaping, drainage, connections to public services and undergrounding of an existing ESB overhead line.

Location

The Rectory Building, Harbour Road Cottages, Mountshannon, Co. Clare.

Archaeological context and background

Mountshannon is sited on the main route from the medieval settlement of Killaloe to the south to Portumna. According to the Clare County Development Plan for Killaloe and District (2023-2029) the development of the village of Mountshannon dates to 1742 when Alexander Woods, a linen manufacturer, was contracted to build fourteen workers cottages, a place of worship and a school. The first edition map of the Ordnance Survey shows that the workers cottages were laid out in a series of regular properties, which extended in a linear form from either side of the main route through the village. By the time of the 25inch map, generally printed between 1909-1913, many of these linear plots had disappeared.

The centre of the village has been designated an Architectural Conservation Area. The Old Rectory is listed on the National Inventory of Architectural Heritage (Reg. No. 20300502. 1900-1910, Rating: regional. Built 1905.

Sources for the archaeological context

A search of the Record of Monuments and Places on archaeology.ie, the website of National Monuments, shows that there are no recorded sites in the immediate vicinity of Mountshannon. There are two sites in neighbouring townlands, see below, and Figure 1.

CL029-061, Cappaduff, designed landscape feature (tree-ring).

Situated on a fairly steep N-facing slope in pasture with good views to N and W. Depicted as a square field on the 1840 OS 6-inch map and indicated as a small oval copse of trees on the 1920 edition. A sub-oval enclosure (diam. 28.5m N-S; 20m E-W) defined by a narrow sharp earth and stone bank (Wth 1.08-1.35m; int. H 0.25-0.4m; ext. H 0.67-1.1m) and a fosse, narrow along a fairly straight W side (Wth 1.58m; D 0.63m) and broader and shallower at E (Wth 2.4m; D 0.12m below external ground level). The bank is only barely evident from SE to SSE and there are two small gaps, one at N and the other at NW but no definite entrance feature. The fosse peters out from NNW to N where a N-S field boundary abuts the site. It is also absent from SE to S near where another field boundary abuts. The fosse has been filled with fallen branches all around obscuring it to a large extent. It may have been deepened along the straight side for drainage purposes. Trees grow all around the bank and throughout the site. The interior slopes significantly to N and a fallen tree lies across the S portion. An internal feature comprises a stony bank or tumbled wall (Width 0.8m) curving from N to SE mirroring the curve of the bank. At N the wall extends W ending at a small stone lined annexe (5m N-S; 4.4m E-W).

There are several 19th century features in the area including named groves, plantations, gardens and badger burrows and this enclosure appears to be part of that landscape.

CL029-007, Curratober, holy well townland.

There is a noticeable cluster of monuments in the townland of Clontymweenagh, close to the shore of Lough Derg. Some of these sites may be related to servicing the needs of the community at Iniscealtra. However there are few Recorded Monuments in the vicinity of Mountshannon.

[Topographical Files of the National Museum of Ireland](#)

A search of the Topographical Files held by the National Museum of Ireland recorded no stray finds for the townlands of Mountshannon, Cappaduff and Dooros.

[Archaeological work](#)

A search of excavations.ie, which records all licensed and unlicensed archaeological investigations by townland and year, does not record any work having taken place in Mountshannon. The nearest site is at Iniscealtra, 'half a mile away across Lough Derg'.

[Monitoring of trial pits](#)

The location of the proposed new extension to the rectory building was subject to the excavation of trial pits (see attached plan, Figure 5).

Excavation of 4 no. trial holes within the application site to a depth of 2m or to rock refusal, including allowance for all required plant.

1 no. rotary core assuming depth of 10m of overburden. Core to be drilled to 10m or to rock refusal. 2m of rock to be proven if encountered. SPTs to be taken and recorded at every 1.5m.

Reinstatement of all trial holes with as-dug material

The excavation of the trial pits was undertaken on 28/02/2022, and monitored by the archaeologist. The trial pits were excavated using a mechanical excavator fitted with a 450mm wide toothed bucket. The trial pits closest to the Rectory building uncovered hardcore overlying geotextile, overlying subsoil. The subsoil consisted of loose gravel or sand, with a pinkish hue, and large rounded granitic boulders. The sides tended to collapse, and pit 2 was relocated.

Pit 2A was excavated to the side of Pit 2. Subsoil was encountered immediately below the existing surface.

Pits 3 and 4 were excavated on the lawned area downslope of the Rectory building. Shallow topsoil, heavily rooted, overlay gravel subsoil, within both pits 3 and 4.

No deposits or artefacts of any archaeological significance were uncovered from any of the pits. The conclusion is that this site contains no deposits of archaeological interest.

Conclusion

Any groundworks close to the shores of Lough Derg should be considered in terms of uncovering prehistoric activity. However, there was no evidence for any features or artefacts of any archaeological significance in the monitoring of trial pits. There is subsequently very slight potential of damage to the subsurface archaeological resource in future construction work on this site.

It is advisable however that monitoring of ground works relating to this development is undertaken.

These opinions are subject to recommendations of National Monuments.

Sources

www.archaeology.ie

www.excavations.ie

National Museum of Ireland, Topographical Files

Solearth Architecture Inis Cealtra Appendix 2 Detailed Support Material.
Clare County Council LAP Development Plan Killaloe and District

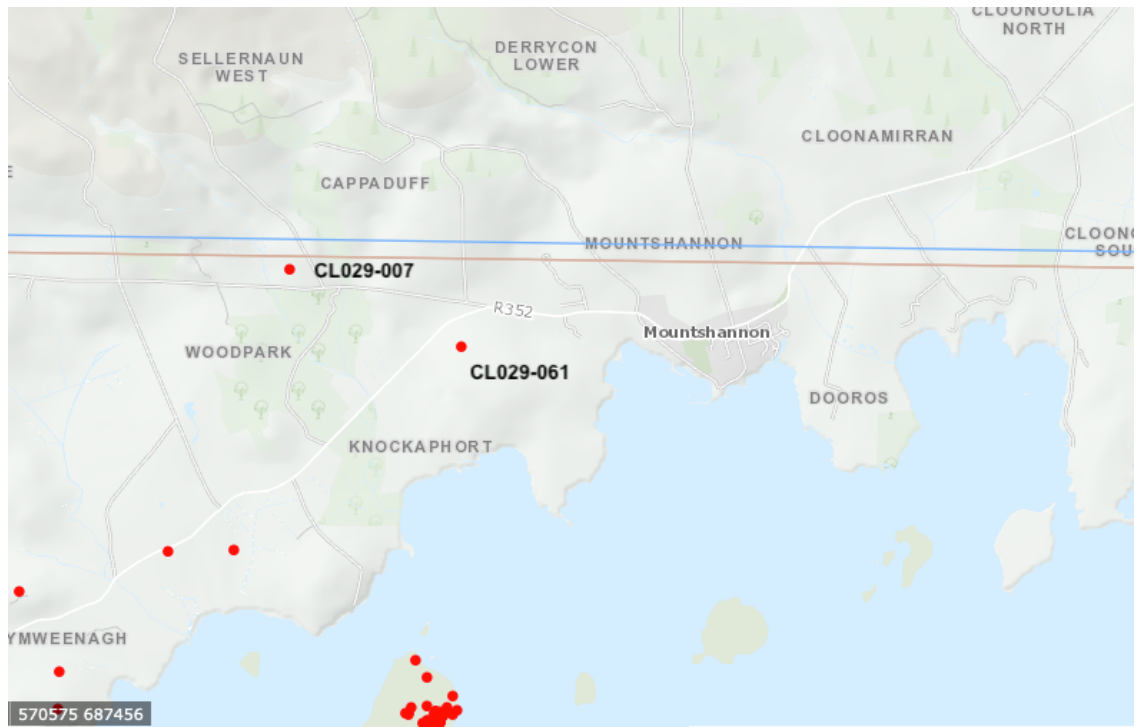


Figure 1. Extract from Sites and Monuments map, archaeology.ie



Figure 2. First edition Ordnance Survey map, 1840s.

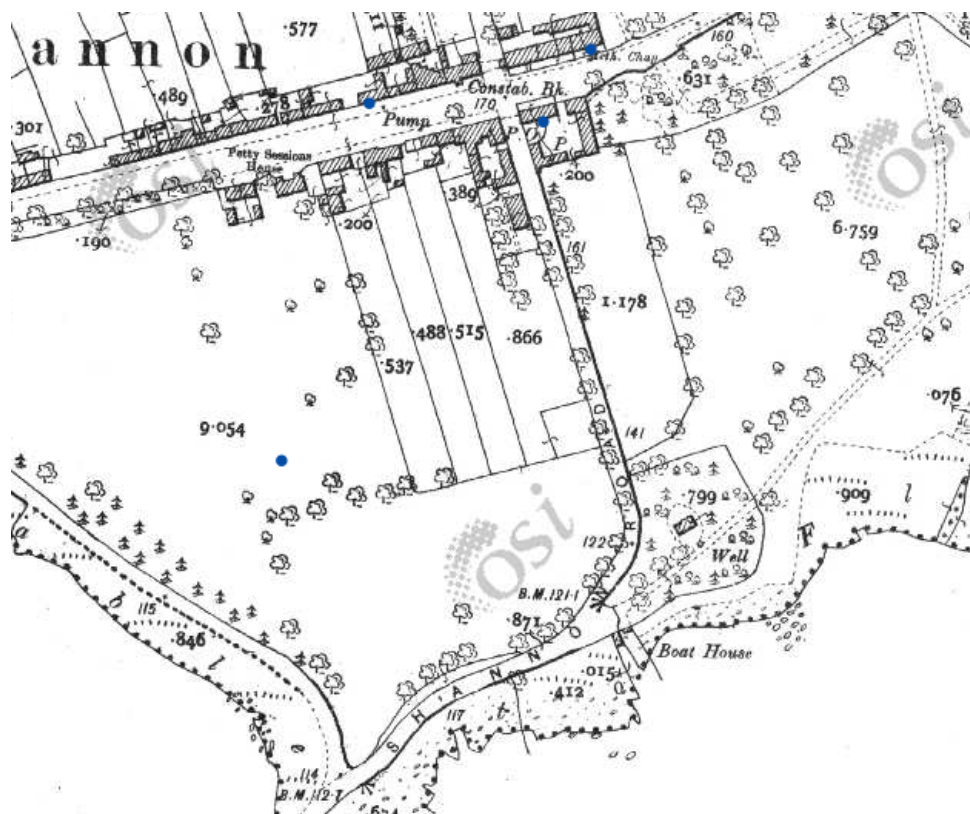


Figure 3. 25in map, 1909-1913, Old Rectory not marked.

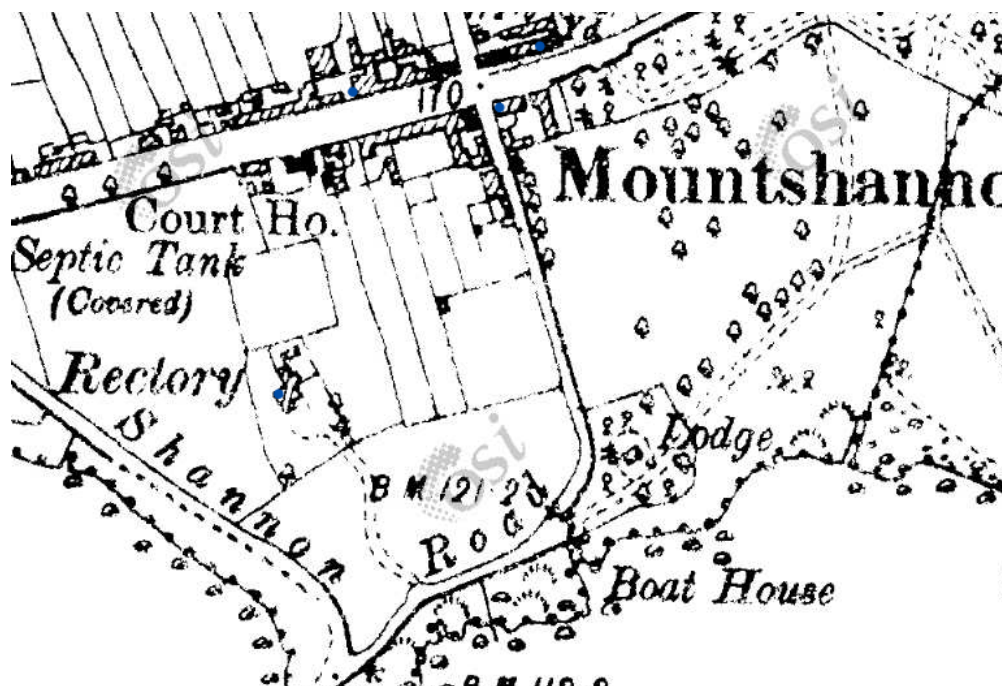


Figure 4. Cassini map, 1940s, showing Rectory.

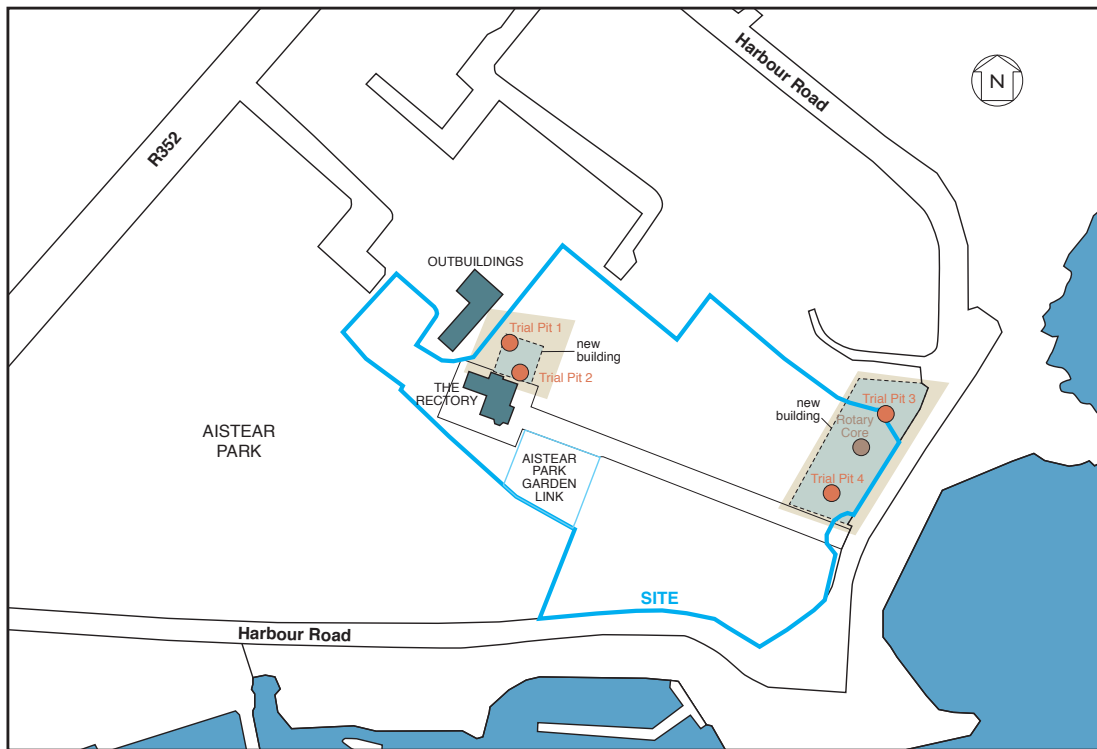


Figure 5. Location of trial holes, Mountshannon.



Plate 1. Hardcore surface over subsoil, Trial Hole 2.



Plate 2. Rooted topsoil over gravel subsoil, Trial Hole 4.

APPENDIX 14.7

EXCAVATION OF ARCHAEOLOGICAL TEST PITS AT INIS CEALTRA



VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DECEMBER 2024



**REPORT ON EXCAVATION OF ARCHAEOLOGICAL TESTPITS AT INISCEALTRA (HOLY
ISLAND), LOUGH DERG**

ON BEHALF OF CLARE COUNTY COUNCIL

**CONSENT: C001400
EXCAVATION: E005746
METAL DETECTION: R000743**

**CLAIRE WALSH
NOVEMBER 2024**

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Introduction

Clare County Council intend to apply for planning permission via EIAR to provide visitor facilities at Iniscealtra (Holy Island), southwest of Mountshannon, County Clare. Iniscealtra is a National Monument and the built heritage is in the ownership of the Minister of Housing, Local Government and Heritage, and the Local Authority. Monuments on the island are also listed on the Record of Monuments and Places maintained by National Monuments CL029-009001- to CL029-009208-

The visitor facilities proposed are three pod units, as follows:

One staff pod

One shelter pod

One WC pod

The pods are to be located close by the existing jetty which will be upgraded and extended to provide a berth for a larger vessel.

In order to facilitate the planning application to An Bord Pleanála, three test pits were hand excavated in the area of the proposed pod locations. The test pits were selected as agreed locations and excavated under a Ministerial Consent C001400. The testpits were designed to determine if any archaeological deposits were present at this part of the island, which has never been subject to archaeological investigation, and lay outside the area of both LIDAR and geophysical survey.

Excavation of the three test pits was carried out on 23rd and 24th September 2024, with assistance from Conor Mc Hale and Isabella Walsh. Pod 3 (test pit 2) is to be relocated slightly further up (east) of the original location, which was test pit 2, in adjustment of the design in late September 2024.

Archaeological and historical background

A very brief summary of the archaeology of Iniscealtra is given below. The location, on a large island close to shore in a low-lying riverine context, is typical of the location of the majority of ecclesiastic settlements, perhaps reflecting a desire to be near communication opportunities afforded by a riverside location. There may also have been a political reason for the choice of location. de Paor (1997) observed that Iniscealtra effectively lay between Munster and Connacht, a strategic location which may have influenced the later patronage of the Ui Briain clan. He states that it is possibly as the result of a territorial dispute that the monastery was refounded from a possible early hermitage in the 7th century.

The island has an important group of ecclesiastic monuments located on the eastern shore. This comprises the following churches or ecclesiastic buildings: St Caimin's, St Michael's, St Brigid's, St Mary's, Tempeall na bhFear nGonta, a shrine (known as the Confessional) and substantial remains of a round tower. A stone monument known as the Bargaining Stone, a Penetential Station, lies near the Lady Well. There are numerous bullaun stones, mounds of stones and earth associated with pilgrim patterns, earthworks and a children's burial ground or 'cillin'. There are 189 individual sites or stone features identified on the island and entered on the Record of Monuments and Places under the prefix CL029-009001....

The churches, round tower, shrine and other principle monuments are National Monuments in the care of the State (Number 5). Sections of land on the island is owned by the State. The remainder of the island was acquired by Clare County Council in recent years. The location of the test pits is on land in the ownership of Clare County Council.

Iniscealtra is recorded in hagiographical myth and legend from the 6th century. The foundation of the holy place is associated with various mythological figures and hermits, including Colum, who died ca549AD. A separate foundation on Iniscealtra is attributed towards the mid 7th century to St Caimin, whose death is recorded in 654AD. Caimin too wished to withdraw from the world, but numerous followers and admirers came to join him on Iniscealtra. According to de Paor the traditions and conflicting dates are perhaps mythological, but the origins of the island monasticism are rooted in the legends of these holy men.

Little is known of the monastery for some centuries. There is a potential link with the cult of St Cronan's church of Tomgraney (St Coonlan of Iniscealtra d. ca750AD). The obituaries of two abbots of Iniscealtra are recorded, Diarmait in 762, and Muchtighern in 785, suggesting that the island had an independent or autonomous monastic existence in the 8th century.

Following AD837, Viking ships and fleets were active on the Shannon, and Iniscealtra was plundered and its community dispersed, under Turgeis's depredations. The death of Coscrach (the miserable) an anchorite of the island, is recorded in 898AD. In 922, Tomrar 'Jarl of the Foreigners' sailed upriver from Limerick and plundered Iniscealtra and threw its books and reliquaries into the water.

The rise of Mathgamain and Brian Boruma to the kingship of Munster, and their firm control of Thomond brought patronage to Iniscealtra. Further obituaries of abbots of Iniscealtra are recorded for 951 and 967 AD. It is recorded that Brian Boruma built the churches of Killaloe and Iniscealtra. Brian's brother Marcan, coarb of Iniscealtra, died in 1010AD. The coarb was the figure with authority over the wealth of an ecclesiastical site.

In 1033AD, Conn Ua Sinnaig, anchorite of Ireland, died on Iniscealtra. Gormlaith, wife of Toirdelbach Ua Briain, died at Killaloe and was buried on Iniscealtra in 1076AD.

An 11th-12th century psalter fragment is attributed to St Caimin (replacing Colum in the local tradition of these later times). In 1111AD Cathasach 'head of the piety of Ireland', died on the island. His cross is now fixed to the inner face of the north wall of St Caimin's Church. This is the earliest inscription bearing cross of the Romanesque period. Cathasach was an ecclesiastic from Armagh so he was probably at Iniscealtra 'in his pilgrimage' (that is away from his original monastery which seems to have been the rule in Ireland for elderly monks who had been invested with important charges).

The monastic history of the island suggests that it continued to be regarded in particular as a place of retreat, penance and burial, becoming known in later centuries as Insula Sanctorum, 'Holy Island'.

Structural changes to the church in the 12th century meant that the old monasteries, absorbed by territorial dioceses, became diocesan parishes. This is evidenced in the scatter of Romanesque churches and the inscribed slabs in the Saint's Graveyard. St Caimin's church, almost certainly built under the patronage of Brian Boruma, was enlarged around 1150 AD, and the small church of St Brigid, dates from the second half of the 12th century.

In the 13th century, St Mary's Church at Holy Island became a parish church. The church appears to have continued to be a parish church until the Reformation, and possibly even as long as the 16th century. Then however it appears that the church roofs were stripped along with other destruction. Bishop Rider in his visitation of 1615 says of Iniscealtra 'Cure not served, being an island and but one house'.

The pilgrimage function of the island is not described until the 17th century. In 1607, twelve pilgrimage sites, including Iniscealtra, were assigned indulgences. Iniscealtra was known, as was Glendalough and

Clonmacnoise, as 'Seven Churches', although there were not this many churches on the island. Bishop Rider referred to Iniscealtra in 1622 as 'ye island of Seven Altars'.

In 1863 a group of British tourists visited Iniscealtra and they were shocked at the state of the island. In one of the churches there were a pig-sty while cattle roamed over the unprotected burial ground. The remains and monuments came into the care of the state as a result of the Church Disestablishment act of 1869 and in August 1878 Sir Thomas Deane, Superintendent of Irish National Monuments, came to the area. The pig-sty seems had gone by then but the graveyards were still unfenced. Two years later it was reported that the Board of Works had repaired the cemetery attached to St Caimin's Church while the Scariff Board of Guardians was bound to do the same for the cemetery attached to St Mary's church. Much more work was also done at this time.

Almost ten years of archaeological excavation was undertaken through the offices of Failte Ireland/ Office of Public Works and UCD from 1970 to 1980, excluding 1978, under the direction of Dr Liam de Paor of University College Dublin. The excavations were envisaged as a long-term programme of research and conservation. A preliminary account of the works was published by de Paor in NMAJ, with a three volume archive completed shortly before the death of the excavator. Post-excavation work has been carried out through the Department of Archaeology, UCD, subject to grant.

Five main areas were excavated, uncovering a range of archaeological features associated with an ecclesiastic site. These include habitation features, mainly a substantial round house, burials, ditches and gullies, pits and other. Samples of suitable material has been dated by radiocarbon, giving a span of 551AD into the early 13th century for differing samples (information from M. Seaver, NMI).

Most of the finds from the excavations date from the 9th century to the later 12th century, with specialist catalogues still in preparation. While struck flints and other miscellaneous finds of probable prehistoric date have been uncovered in the excavations, no specific features of prehistoric date were identified. There was however a group of prehistoric finds, including hollow based flint arrowheads and stone axes from an area north of St Brigid's church.

Other surveys

Clare County Council commissioned the following surveys which have contributed considerably to the archaeological background to the island. This includes dive surveys, which identified several log boats, specifically off the north-east corner of the island, where the divers identified a probable landing stage of the monastic period. Following a large scale underwater geophysics survey, a larger scale dive survey off the west shore of the island has not identified much material of archaeological significance.

A LIDAR survey of the island identified large plough furrows over much of the northern part, probably associated with the habitation described by de Paor as 'the cottage', a two roomed dwelling of post-medieval date on the northeast side of the monastery. Some potential post-medieval small enclosures towards the south-eastern shore, south of the monastic complex, may be remains of habitation.

Post- excavation analysis

Preliminary analysis of the finds assemblage, faunal and burial material collected by the 1970-1980s excavation has been undertaken. This included selection of samples to be submitted for C14 dating. The earliest radiocarbon date obtained from a feature excavated to the West of St Caimin's Church was the

date of 551-639AD (O' Sullivan and Seaver 2015, 35). Other significant dates recovered include one of 9th century date (also corroborated by artefact) for the boundary ditch on the west side of St Brigid's Church. The D-shaped outer enclosure around St Michael's was constructed in the 10th or early 11th century.

Material from a pit close to the Confessional returned a C14 date of 775-961AD. A date in the 10th century for the construction of this structure seems likely and suggests an overall period of building in stone to include the earliest church of St Caimin and of the Round Tower.

Burials

Some in situ recording of burials was undertaken during the period of the excavation. A further total of 58 individuals was examined, as well as disarticulated material which represents a minimum of a further 25 individuals. Of five samples submitted for C14 dates from the burials around the round tower, all are early medieval. Males, juveniles, and female were represented. Most of the burials from north of St Caimin's church were male, although female and juvenile were also present.

The burial of a young woman in the outer ditch of St Michael's was dated to the period 1024-1163 and is considered deviant.

Early medieval enclosure on Iniscealtra

A geophysics survey of the island revealed the most significant information of the non-invasive studies recently undertaken by Clare County Council. A defining characteristic of early Irish monasteries is the enclosure, or series of enclosures. These are thought to define the legal area belonging to the ecclesiastical settlement, and some scholars have argued that Irish ecclesiastical settlements were designed to a set pattern with the sacred core that was surrounded by a number of concentric boundaries demarcating areas of decreasing holy importance. A double-ditched D-shaped enclosure, probably the earliest manifestation of the monastic 'vallum' was identified at the eastern part of the island. This encloses St Caimin's church and Saint's Graveyard, and the shrine/ Confessional, and appears to extend to the lake shore. The northern section of the enclosure is covered by scrub, meaning that no survey could be undertaken in that area. The majority of ecclesiastical sites had an enclosure between 90-120m in diameter, however larger ecclesiastical sites could extend up to 300-500m in diameter. There were of course, exceptions to the circular ideal, with rectangular enclosures at Iona, a semi-circular enclosure at Clonmacnoise, and a rectangular vallum suggested for Inch, Co. Down.

The double ditched enclosure at Iniscealtra describes an internal area with a diameter of c.170m across the inner enclosure, and c. 220m across the outer enclosure. The inner enclosure ditch is more continuous than the outer, with a gap or probable entrance through both at a point to the south west of St Caimin's church.

Much of the excavated evidence from Iniscealtra accords with that from other ecclesiastic sites. Craft working was carried out at the western end of the monastery. This included copper working, iron smelting/ reduction, and evidence for antler comb manufacture.

Paved pathways were uncovered at several locations through the excavations at Iniscealtra.

Summary of de Paor's excavation findings

The excavations indicate that the island was occupied more or less continuously from a date c. 600 down to the 19th century. Burial was practised from an early period, and continues to this day. The chief period represented for the monastery was from the 10th century to the end of the 12th century. The main radial elements of the island appear to date to an earlier period. A small number of artefacts of ecclesiastic function indicate activity of the 7th- 8th centuries. A few fragmentary sherds of Bii-ware of 5th-7th century date were found, indicating connection with the early wine trade. Some Late Roman amphorae were stamped with early Christian symbols, such as the Chi- Rho, which is present on a stone from Iniscealtra. De Paor had dated this to the 7th century, but it may be of 6th century date. E-ware from France, dating to the 7th/8th centuries, was also recovered in small quantities.

An overlay of the excavation trenches and the geophysics results shows that the excavation trench missed the inner enclosure ditch which appears to have had an entrance at this location.

The final years of occupation of the island are characterised by intensive pilgrimage, accounted by Lewis (1837) and O'Connor (Ordnance Survey Letters). The cottage appears to date to the 18th/ 19th century, and St Brigid's Church was adapted into a two room dwelling. Occupation on the island may have been seasonal.

Tillage with a plough- indicated by the high notable ridge and furrow marks, also including potato growing- the final layer of agricultural activity south of the cottage identified by de Paor's excavation, pasturing of cattle, continued when the island was probably no longer inhabited.

Neither of the modern piers are included on the RMP. Both are of stone and capped with concrete. The pier on the north-west side of the island will be the site of the proposed new jetty. The mooring rings on the western jetty, as at Knockaphort pier, are made of horseshoes set into the concrete.

Fisherman's Hut

This structure was built in the 1960s with support from the ESB (information from Ger Madden, cited in O' Leary et al 201). The hut has a doorway on the north end of the east wall, and a single window in the same wall. A small fireplace is built into the south west corner. The roof is of galvanised sheet metal, laid on timber rafters. The walls are of poured shuttered concrete. The hut has a concrete plinth externally, with iron fence posts sunk into it, although the connecting fencing is gone. The hut will be demolished prior to the erection of the pods.

The test trenches

Three trenches were opened. The method for each was as follows:

Turf/ sod removed by spade/ mattock and laid nearby

Soils scanned by metal detector (Minelab) under metal detecting licence R000743

Excavation by trowel and hand shovel of underlying soils to subsoil, with scanning by detector.

The results of each of the trenches is given below.

Trench 1

Trench 1 was located west of the fisherman's hut, on the ground which led to the lakeshore. The trench measured 1m by 1m, and was excavated to a maximum depth of 220mm below present ground level. The intervening soils were comprised of heavily rooted topsoil over compacted grey mark and stone-subsoil. There were many subangular stone spalls and some rounded, water-rolled stones in the topsoil. A length of wire- fencing- and a sherd of glazed white ware crockery of late 19th-20th century date were recovered from the soil overburden.

The fisherman's hut appears to have been constructed on a rectangular concrete plinth, surrounded by metal fence posts. Several of these were broken off just above ground level.

There was a high level of contamination (visitors debris, using the comparative shelter of the hut as an outdoor privy) which meant that no further work was undertaken closer to the hut. There was a quantity of broken window glass in the topsoil.

Trench 2 was located to the north of the track up to the monastic complex, and measured 1m by 1m. Rooted topsoil was present to a depth of 300mm below present ground level. The maximum depth to subsoil was 620mm, but varied from 420mm to 620mm. There was a hollow in subsoil at the north-west corner of the trench, due possibly to water scouring over the stoney sand accretion which overlay bright yellow sand, interpreted as subsoil. Irregularly banded pale brown silts and bleached sand with very fine gravel lenses, all lightly rooted, formed the bulk of the deposits exposed in this trench. This could be interpreted as deriving from hillwash and ploughsoil, as the trench was sited at the base of a slope. The only find from this trench were rare whole, and fragments of, tiny white marine molluscs, indicating also periodic inundation of this area from lakewater.

Trench 3 was located upslope of the fisherman's hut. The original proposed location was within the animal pen, but the grazing flock of sheep on the island were in the pen on Monday. The farmer pointed out that the surface of the cattle crush was of stone, laid down when the island was used for grazing cattle.

The trench measured 1m by 1m, and was excavated to a depth of 480-580mm below present ground level. The intervening soils were very heavily rooted- this area supports many semi- mature trees. Barely undifferentiated yellow/ brown ploughsoil was present to shattered bedrock subsoil. Two small pieces of iron slag were recovered from the upper level of rooted topsoil.

No other finds or features, including charcoal or other anthropogenic material, were noted in this trench.

All the test trenches were backfilled when recording was completed.

Construction method, Impact and mitigation

It is proposed to construct two pods on and close to the existing fisherman's hut, which will be demolished in advance of the work. The present hut is constructed on a concrete plinth, which extends c. 1.50m beyond the walls of the hut in all directions, and extends down below the present ground level. The construction of the hut with attendant fencing and cattle crush has resulted in a considerable degree of disturbance and incorporation of modern debris into the shallow topsoil. Shallow topsoil overlies a clear subsoil horizon as uncovered in trench 1. Due to the relocation of the WC pod east of the jetty and south of the existing trackway, it is advisable that a test trench for archaeological purposes be sited here. It is considered very unlikely however that archaeological deposits will be uncovered at the site of the WC

pod: this area is presently very overgrown, but natural rock outcropping is visible, which tends to mitigate any survival of archaeological deposits.

Each of the larger pods will be built on screw piles. 'The pods will be made up of two distinct elements, a lightweight timber oak exo- frame resting on mini pile foundations and an oak- framed oak clad pod structure which will sit into this frame' (Drawing INC2-P-ISL-105-A, MCM). Each will measure 7700mm by 3575mm. The WC pod will be of similar construction, while measuring 6100 by 3575mm.

The pods will not be visible from the monastery due to the fall in elevation from the top of the island to the eastern shoreline and the presence of dense vegetation in the location of the pods, much of will be retained for screening (See drawing INC2-ISL-P-150, MCM).

The process of the construction of the new jetty will be discussed here, as it precedes the pod construction. The sequence as outlined in the CEMP prepared by Malachy Walsh Partners, dated November 2024, is as follows:

- Pre-commencement activities including site investigation work and pre-construction surveys
- Pre-Construction Activities including
- Site Clearance Works to allow for the new jetty to be constructed
- Construction of temporary site construction compound
- Construction of new floating access jetty and walkway located at Northwest of the island where the existing mooring point is located.
- Site Clearance Works to allow for the remaining works on the Island
- Demolition of a structure on the island
- Construction of 3no. new staff and public welfare facility "pods" on the island
- Construction of new pedestrian paths on the island
- Complete site works, tidy up site, landscaping, restoration
- Demobilise site compound facilities

It is expected that the construction works on the island elements of the works (construction of jetty/ demolition of existing shelter / construction of pods & paths) will require approximately 25 personnel including during the peak construction phase, to include site contractors, engineers, materials delivery personnel, environmental personnel, health and safety personnel.

Site Investigation works will be conducted at the proposed jetty location in advance of the main works to inform the detailed design for the jetty.

- The drilling rig will be transported by the Coill an Eo workboat to the site and placed on the Pontoon raft. After securing the rig to the raft the raft will mobilise to the locations shown in Figure 5 as GI1, GI2 and GI3.

- Boreholes are drilled at each respective location (See figure 5) to verify the geotechnical profile of the site. Samples are recovered and sent to lab for testing.

The new proposed design is a breakwater jetty located at the site of the existing slipway. The existing slipway is a narrow concrete covered stone structure suitable only for very shallow craft. 4 number 800mm dia (max diameter) steel piles will be required to retain the jetty. It is planned to install a 9m long x 1.5m wide max ramp to allow safe access from the Land (fixed) to the jetty (floating). This will require 4 number 203mm H piles to support the concrete (2m x 2m) anchor base that retains the ramp anchor points. These piles will be vibrated into the bed by an excavator on the pontoon raft along the stone causeway on the Southern side and the piles will be hidden inside the stone filled gabions to the Island. Similarly, 2 254mm x 254mm H piles will be required to retain the Canoe Launch section in the sheltered side of the land Structure. They will be vibrated also into place by the excavator on the Pontoon raft. It is envisaged that the programme of works will take approximately 5 to 6 weeks to complete.

Some of the fleet required to complete the installation of the floating jetty are the COill an Eo workboat, the Inish Muilinn workboat and the 16-unit pontoon raft with an excavator on board. The pontoon raft requires a draft of 0.4 metres and can be up to 0.6 metres when fully laden. It is held in position by spud legs dropped by gravity into the lake bed or pushed into the lake bed by the excavator on board based on the type of working activity.

The proposed layout is a 4 metre wide breakwater jetty with 4 number 800mm (max) diameter piles core drilled into the lake bed. A 9 metre access ramp will provide access from the Island. This ramp will be secured on the mainland to a concrete base that will sit on stone gabions at the front face of the access causeway. Also attached to the causeway is a 7 metre ramp to a Canoe launch at right angles to the causeway.

The excavator with the piling attachment will drive the outer H piles and outer trench sheet piles from the pontoon raft and will then track off the pontoon raft (held in place by 2 spud legs pushed into the lake bed) on the South West Side of the access causeway onto timber mats placed in advance from the excavator on the pontoon raft and drive the remaining trench sheet piles. During the construction of the causeway the excavator will travel on the timber mats over the travel area for the excavator to work. The excavator will be working in a depth of water up to 0.6 metres. • The excavator will vibrate the trench sheets with the piling attachment into the bed and to a depth designed based on the Ground Investigation results. The trench sheets will be stored on the Pontoon raft.

- The excavator will place gabion mattresses (1m x 2m x 0.9m) filled with broken washed stone (filled at Mountshannon Harbour) and transported out on the pontoon raft) on the exposed side of the existing causeway structure and inside the trench sheet wall. There will be some loose stone infill required during the construction. 1m³ bags of stone will be transported from Mountshannon Harbour and the excavator will lift the bags from the pontoon raft and spill the stone at the required locations.

- The front face of the causeway will have a Trench sheet face finished on top with a concrete anchor block supported by 4 number 254 x 254 H piles driven into the lake bed. These piles will be driven by a piling attachment on the excavator (and vibrated into the lake bed. This concrete platform will be constructed and poured the shuttering of the anchor base area is complete. There will be a timber fender bolted to the top of the Trench Sheet Piles and will act as a screed for the concrete finish. Concrete for the base will be ready mixed locally and delivered to Mountshannon Harbour where it will be poured into small skips and delivered on the pontoon raft to the site where the excavator will pour the skips into the shuttered area. This concrete platform will be the anchor point for the Ramp to the Floating Jetty. The exposed face (SW) of the causeway will be faced with 300 to 600mm large stone to break the wave. The stone will be placed on the pontoon raft at Knockaport and shunted by workboat to the site.

The floating jetty sections will be delivered to Mountshannon Harbour where they will be assembled over water at the Harbour and then towed by the Coill an Eo workboat to the proposed jetty location. A core drilled rig will also be loaded onto the pontoon raft at Mountshannon slipway and travel to the jetty mooring location.

4 piles (P1 -P4) will be core drilled into the lakebed size to a depth based on the GI results. Excavation of the lake bed will be required on the South end of the main breakwater jetty (see Waterways Ireland's Drawings). The excavator with digging shovel will remove the material (2m³) and place on a skip on the pontoon raft. This material will be removed off site. A silt curtain will be placed around excavation area when removing material.

The jetty will then be pulled into place with the WI tugboat and anchored with pile guide brackets. The 2 H piles for the canoe launch will also be driven by the excavator from the Pontoon raft. The canoe launch will be accessed to the causeway via a 7 metre ramp. The canoe launch will have a freeboard of 300mm to the water line.

The access ramps will then be placed with the aid of the Excavator on the pontoon raft at the locations shown for the Causeway construction to the concrete anchor platform. It is envisaged that the programme of works will take approx. 7 to 8 weeks to complete.

Mitigation: the area for the pontoon and proposed jetty location has been surveyed both by underwater geophysics and a dive survey. No archaeological deposits have been noted. Appropriate archaeological monitoring under ministerial consent should form part of the process. This will include monitoring of the Ground Investigation piling, the resultant samples taken, monitoring of the piling for construction, and monitoring/ inspection of the material to be excavated from the lake bed at the south end of the main breakwater jetty.

The following section concerns the CEMP for the demolition of the fisherman's hut and construction of the pods on the island. The following sequence will ensue:

- Secure site and erect fencing, hoarding, and signage as required;
- Install any bunding and/or run-off controls where required;
- Identification of temporary stockpiling and storage areas;
- Set up contractor welfare facilities and site accommodation.
- Provision of temporary power, lighting and water services.

- Dredging works at the proposed jetty at Inis Cealtra is not envisaged.

Prior to construction commencing, on site, demarcation of the construction site boundary will be undertaken. Hoarding/ Fencing will be erected to secure the site for safety reasons. The island will close to the public during the course of the works, but for access for the farmer/ for a funeral should it be required will be permitted, and this will need to be arranged in advance with the Contractor to allow for safe access.

Following demolition of the fisherman's hut and removal of the material off the island, a temporary site construction compound will be set up upon commencement of the construction phase of the works on the island at the location shown indicatively in Figure 7 beside the existing slipway. The compound will be used as a secure storage area for construction materials and excess spoil, and it will also contain temporary site units to provide welfare facilities for site personnel.

If existing scrub vegetation is present where a pod is proposed to be constructed, clearing will occur using a flair mower. If grass is present where a pod is proposed to be constructed, clearing will occur using a lawnmower.

This work will be performed outside of the bird nesting season to ensure no disturbance occurs. The area is then landscaped to the Landscape Architect's specification.

The pod foundations will be supported by a series of screw piles installed to a depth sufficient to ensure a stable load-bearing capacity. Installation will be carried out using a tracked mini-digger equipped with a screw pile anchor drive attachment. The exact number of screw piles will be determined based on the pod dimensions.

The pods' structural frames will be built on-site using treated timber. The timber will be brought from the mainland by boat, unloaded at the new jetty, and stored nearby. It will then be taken to the pod locations, where it will be assembled into the structural frames.

The structural frame of the pods will be clad with timber inside and out, including the walls, floor, and roof. The timber will be transported by boat, stored, and then installed in the pods. The envelope will be insulated and fitted with necessary membranes to ensure it is airtight and weatherproof. Timber windows and doors will also be installed.

The WC unit will be of similar construction type, fixed on screw piles.

The works on the island are to be completed at times of dry weather when the ground conditions are appropriate so that the potential for scoring deep tracks is minimised in so far as is reasonably practicable.

The suggested mitigation is for archaeological monitoring under Ministerial Consent from National Monuments to be undertaken as part of the works, at all stages that the archaeologist and National Monuments consider to be appropriate. The project design and the proposed implementation will have minimal, if any, impact on the important archaeological resource of Iniscealtra.

The mitigation measures will be issued as conditions of planning from National Monuments to Clare County Council.

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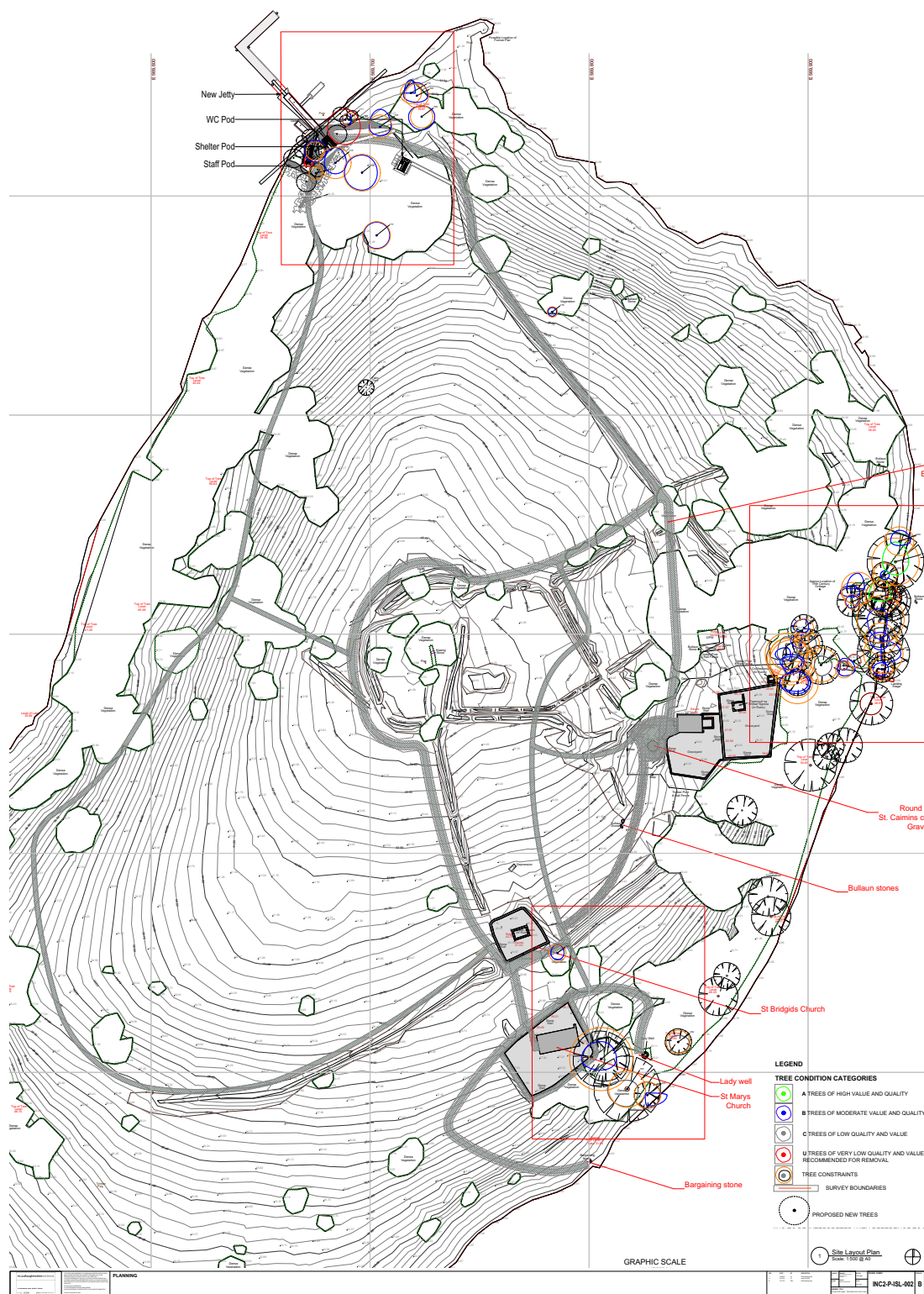


Figure 1. Plan of Iniscealtra showing location of proposed pods

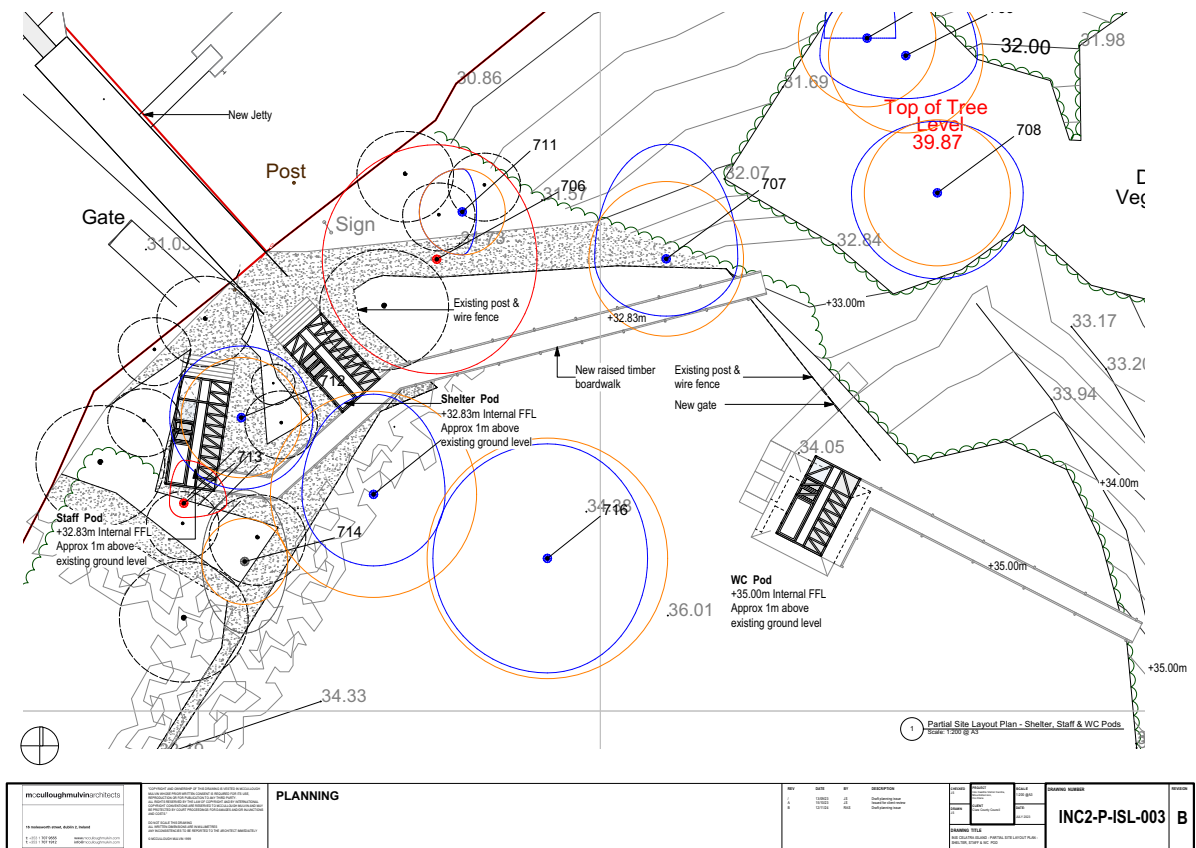


Figure 2. Partial plan of island, showing pods against present landscape

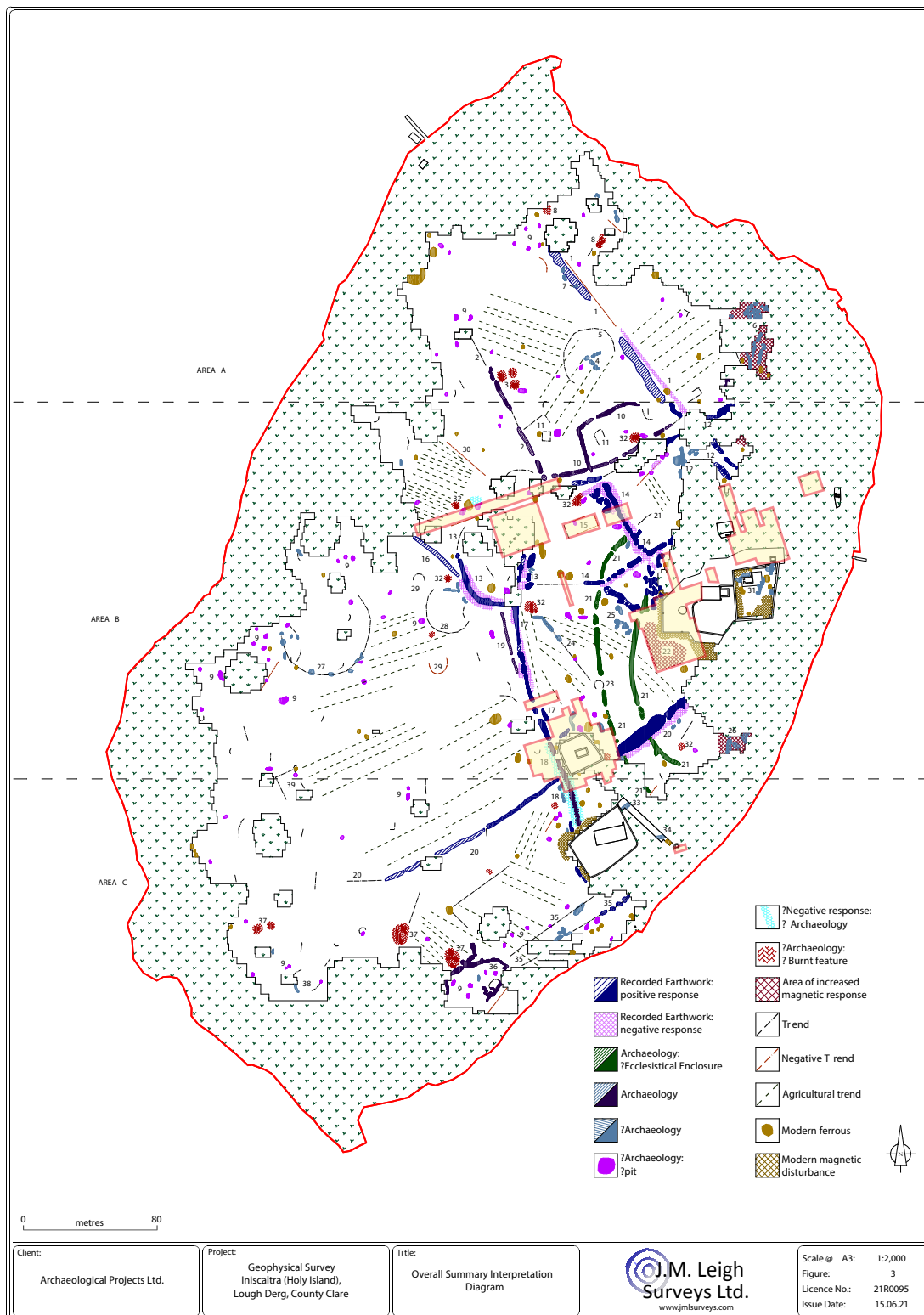


Figure 3. Overlay of de Paor's excavation trenches on geophysics survey

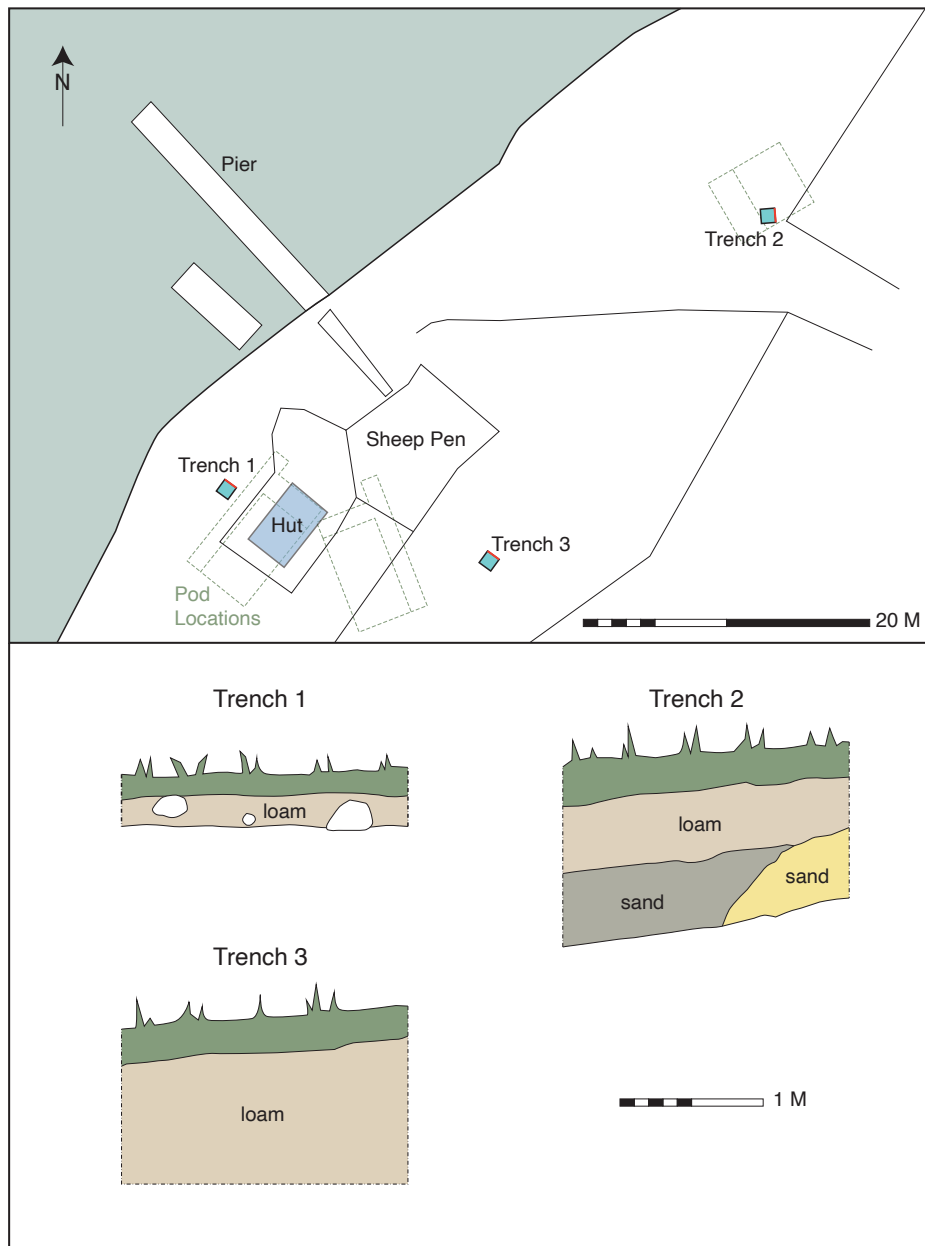


Figure 4. Location of test pits September 2024

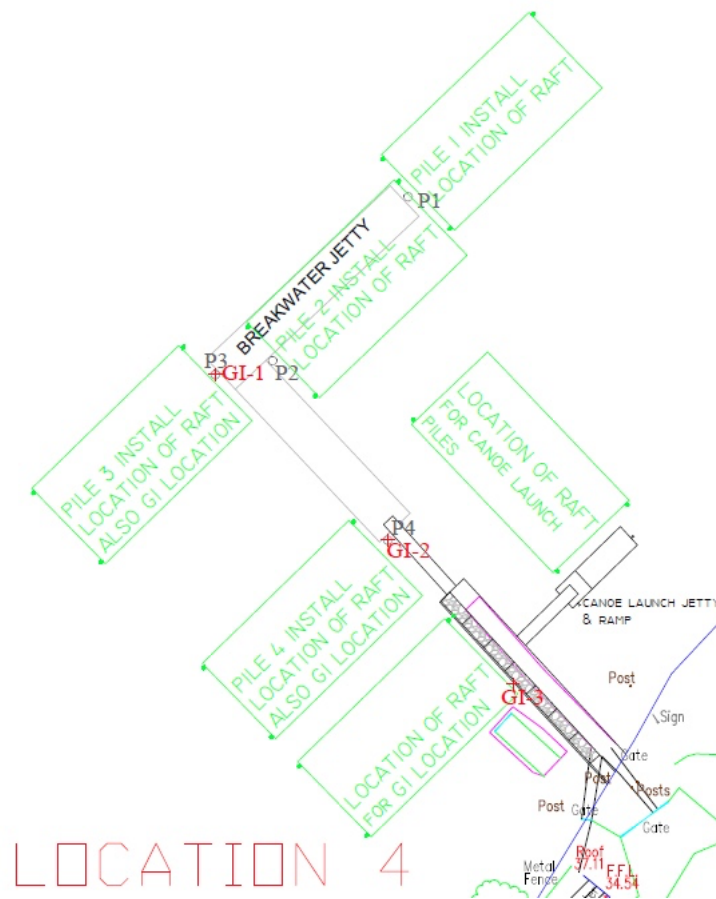


Figure 5 . Jetty with proposed SI locations, from MWP CEMP

LOCATION 4

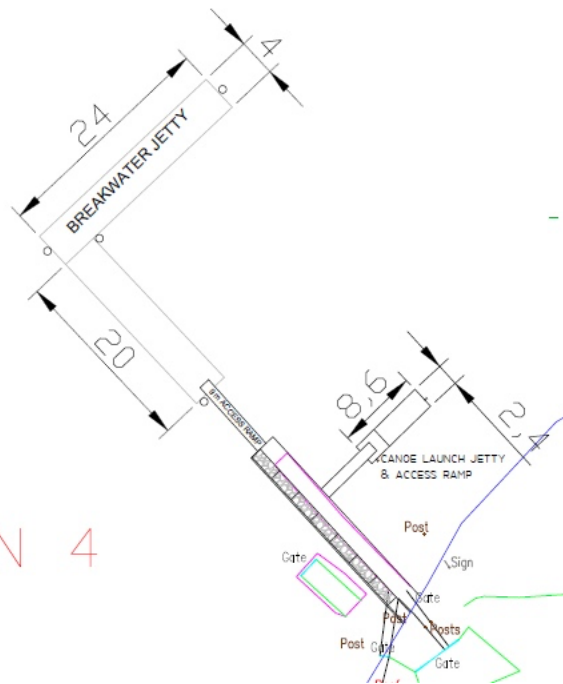


Figure 6. Proposed jetty layout, from CEMP

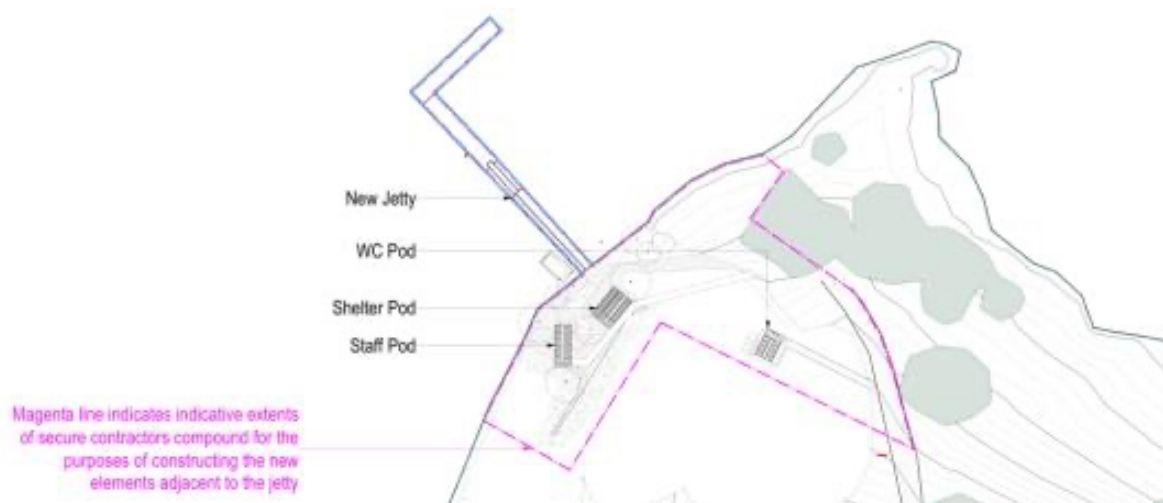


Figure 7. Indicative Location of main contractor's compound on Iniscealtra



Plate 1. View of path from jetty to monastery, showing flanking boulders



Plate 2. Hand-excavation of Trench 1 west of fisherman's hut



Plate 3. View from north of fisherman's hut and fencing



Plate 4. Marking out abandoned trench in animal crush



Plate 5. Trench 1 dug to subsoil



Plate 6. Trench 2 excavated to subsoil



Plate 7. Mollusc recovered from sands in Trench 2, pen for scale



Plate 8. Trench 3, excavated to subsoil



Plate 9. Path from monastery at flank of vegetation covered knoll



Plate 10. View of knoll at north-west side of island, from east