13.

Aquaculture

Aquaculture site development, Clogga Point

Geotechnical Desk Study

RP001

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Contents

1 Introduction

Arup has prepared a geotechnical desk study report for the proposed Aquaculture site development, Clogga Point, Co. Wicklow. This report was prepared using publically available and easily obtainable reference material.

The flipper delta anchors proposed for the aquaculture development rely on the resistance of the ground to augment the self weight of the anchor to provide an increased proof load that would be gained by the self weight alone.

The proof loads specified by Irish Mussel Seed Company are established under the assumption that the overburden is sand. The purpose of this report is to investigate the expected ground conditions by desk study to verify Irish Mussel Seed Company assumptions or otherwise.

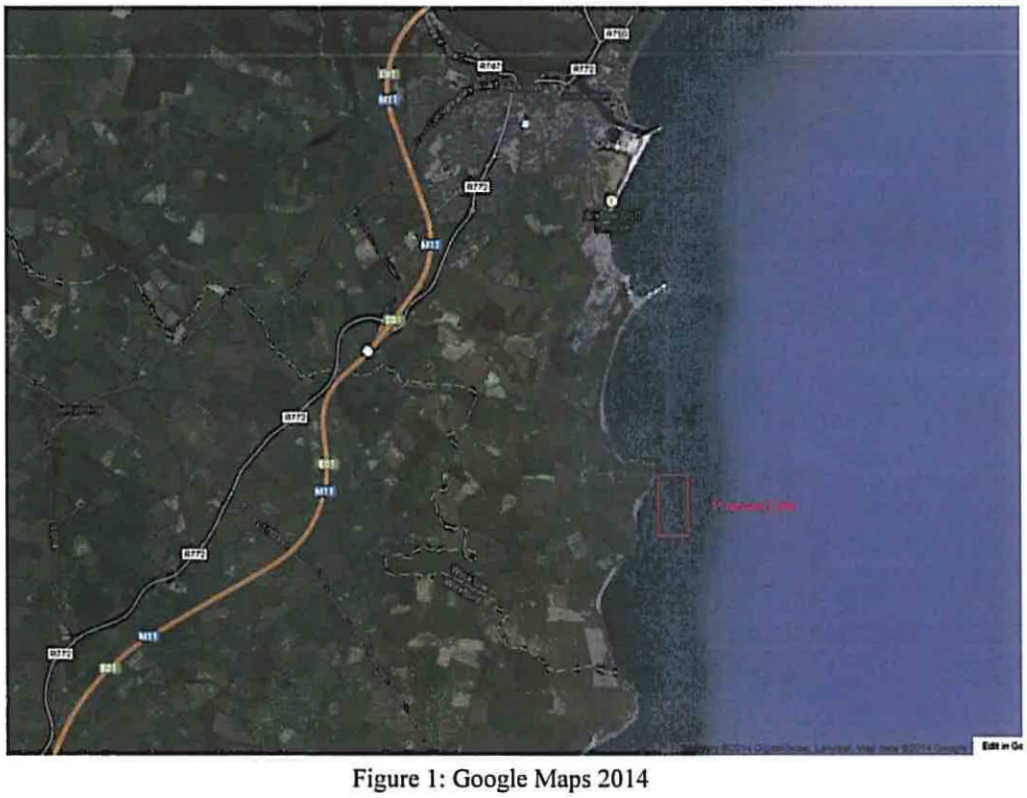

Figure 1: Google Maps 2014

2 Site Location

The proposed site of the Aquaculture development is off the coast of Clogga Point, 4km south of Arklow, South Co. Wicklow as shown in Figure 1 and Figure 2. The coordinates of the site corners are shown in Table 1. The adjacent coast line is farmland and an isolated beach.

Directly to the north of Clogga Point is Clogga Beach which is accessible to members of the public. North of Clogga Beach is Arklow Rock and the Roadstone Quarry and Jetty. North of the Roadstone Quarry is Arklow South Beach and then Arklow Harbour.

To the south of the site is a number of isolated beaches and Kilmichael Point.

Figure 2: OSI 2000

Table 1: Coordinates of Site (Irish National Grid)

Easting	Northing
325870	168715
326470	168715
326470	167615
325870	167615

3 Water Levels and Tides

The depth of water in the area of the proposed development is estimated as between 6m and 12m based on the 2013 Admiralty Chart shown in Figure 2. An extract from Admiralty Tide Tables Volume 1 showing the typical tidal levels for Clogga Point are shown in Table 2.

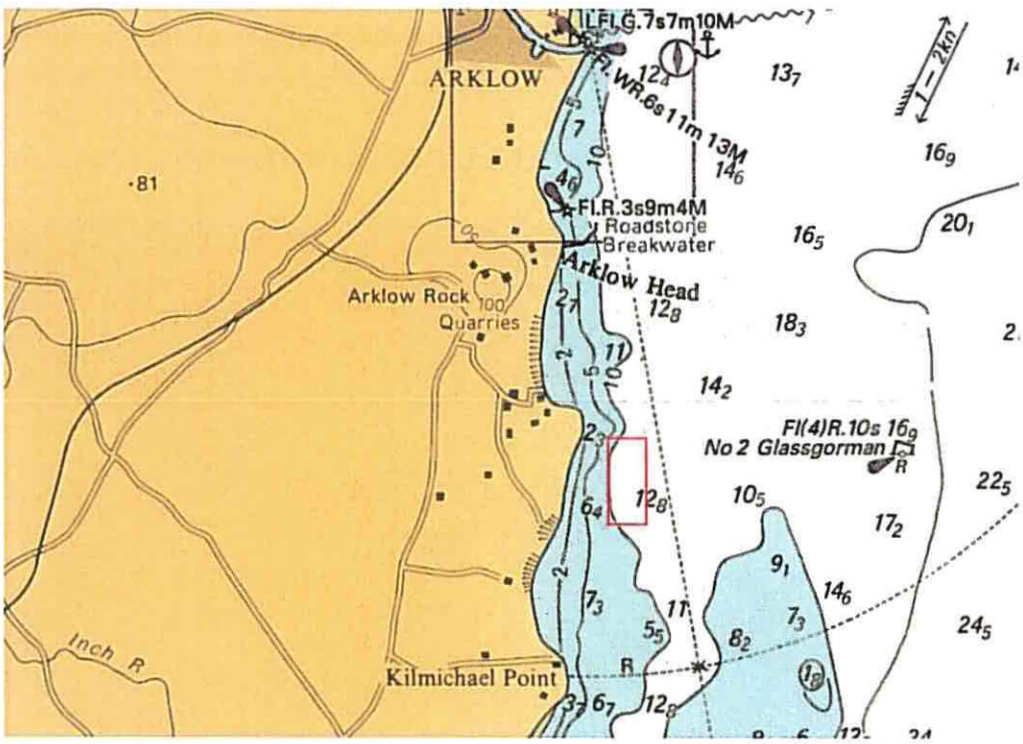

Figure 2: Extract from Carnsore Point to Wicklow Head Admiralty Chart, 2013

Table 2: Tide Levels

Tide	From Tide Tables
	Datum: CD
HAT	0.48 m
MHWS	1.4 m
MHWN	1.2 m
MLWN	0.9 m
MLWS	0.6 m
LAT	-0.82 m
Notes	CD 1.12 m above OD Malin

4 Offshore Geology

4.1 Offshore Bedrock

For the purposes of this desk study offshore geological information was acquired from the freely available OneGeology Internet Portal: (http://portal.onegeology.org).

Here a dataset from the Federal Institute for Geosciences and Natural Resources (BGR) was accessed to provide information on the bedrock present offshore. The bedrock along the coast of Wicklow and North Wexford is described as Cambrian Silurian dolerite/dolostone/claystone/mudstone/conglomerate.

A previous offshore site investigation carried out approximately 5km north of the proposed site encountered the following bedrock:

"Below the superficial deposits, moderately weak to moderately strong PHYLLITE and SILTSTONE was encountered from 6.4m below sea bed level (bsl) to 10.25m bsl. Based on tactile assessment and Point Load Indices of <1MPa the bedrock was described as moderately weak to moderately strong."

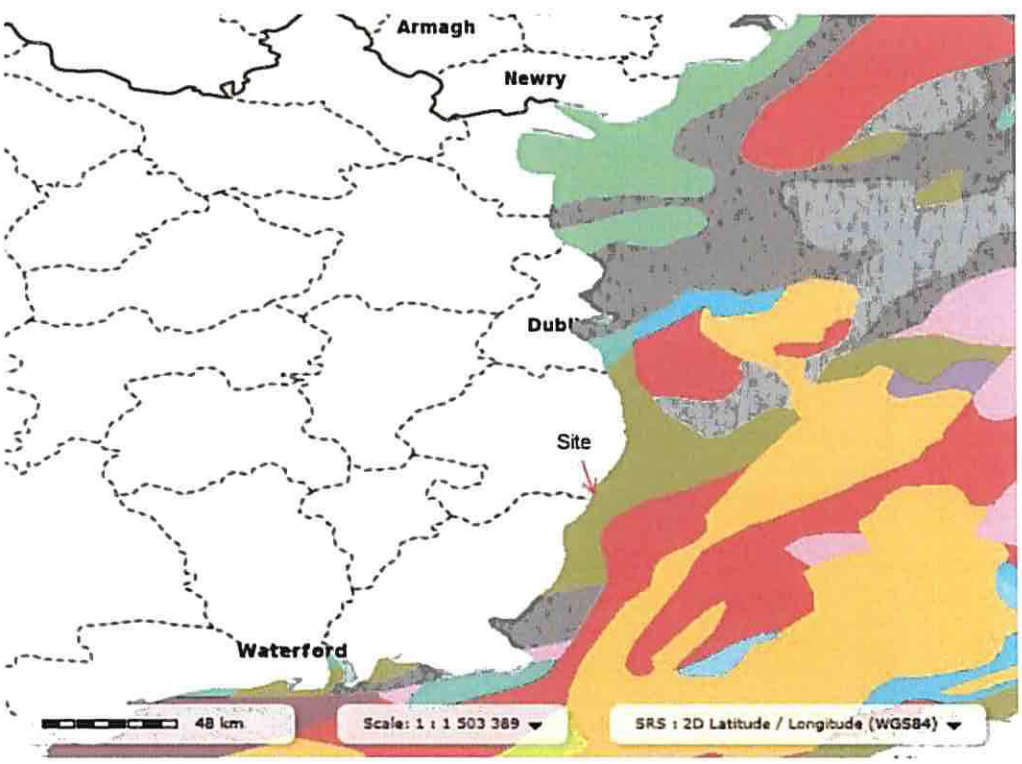

Figure 3: Extract from the Europe BGR 5M Geological Units – Offshore (http://portal.onegeology.org)

4.2 Onshore Geology

The onshore bedrock for Clogga Point was acquired from Geological Society of Ireland. It is described as Lower Middle Ordovician slate/sandstone/greywacke/ conglomerate as shown in Figure 4. An image of the exposed bedrock on the north of Clogga Point is shown in Figure 5.

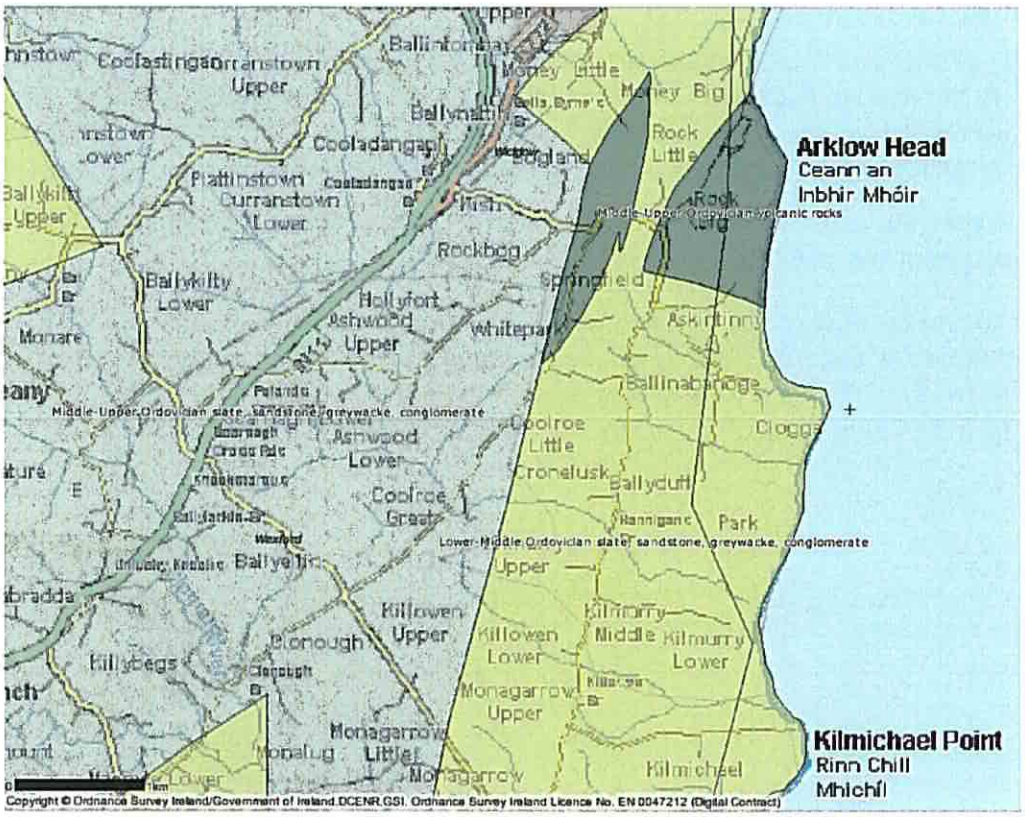

Figure 4: Extract from the GSI Datasets Public Viewer Bedrock 1:1 Million Solid Geology

Figure 5: Image of Exposed Bedrock on the North of Clogga Point, Arup.

5 Sediments and Subsoil

5.1 Offshore Sediments

The information on offshore sediments on the OneGeology website shows the site in an area of mixed sediments as shown in Figure 6. However, this may be the default material assigned to areas not surveyed as it follows the coastline. Therefore the sediments could be sand and muddy sand as indicated for the area directly east of the mixed sediments zone.

The British Geological Survey's series of seabed sediment maps as shown in Figure 7 shows the sediment in the area of the site as Sand.

A Trinity College Dublin thesis entitled "Arklow Rock: a shifting-bed model investigation" involved the acquisition of samples of sediment off Arklow Rock in the 1970s. These samples were determined to be sand.

A previous offshore site investigation carried out approximately 5km north of the proposed site encountered the following ground conditions:

"The site was typically characterised by medium dense to dense SANDS and medium dense to very dense GRAVELS from sea bed level to depth 1m below seabed level (bsl) to 4m bsl. These deposits were underlain by stiff to very stiff sandy gravelly CLAY with Cobbles/ Boulders to a depth 6.4m bsl to 11.6m bsl. Boulders were described as medium strong to strong point load index 10MPa and an Unconfined Compressive Strengths of 40MPa."

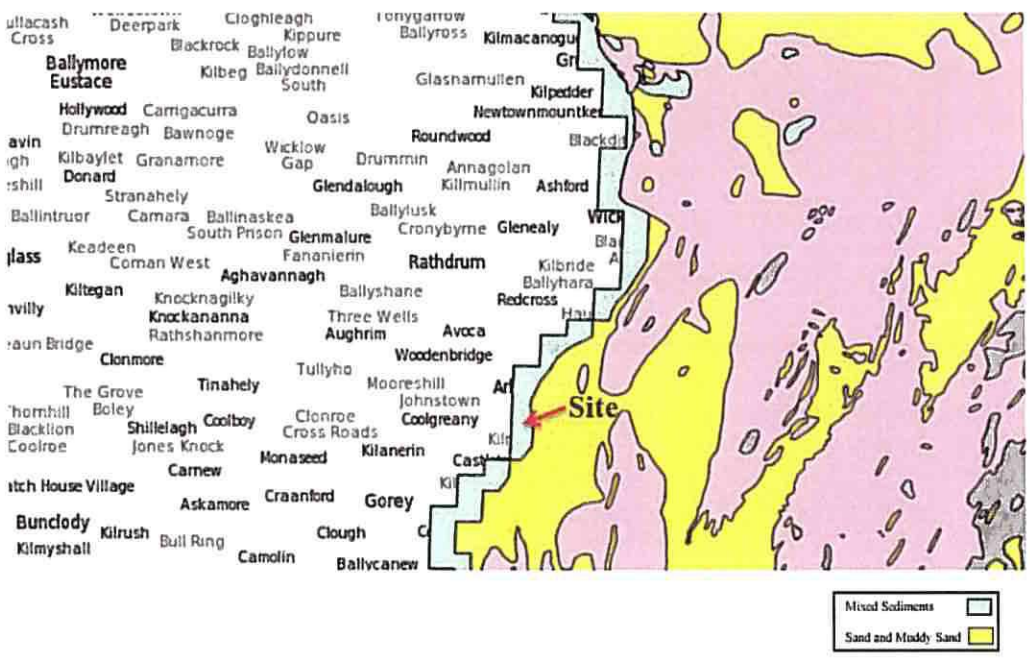

Figure 6: Extract from the UKContShelf BGS 1:1M Seabed Sediments (http://portal.onegeology.org)

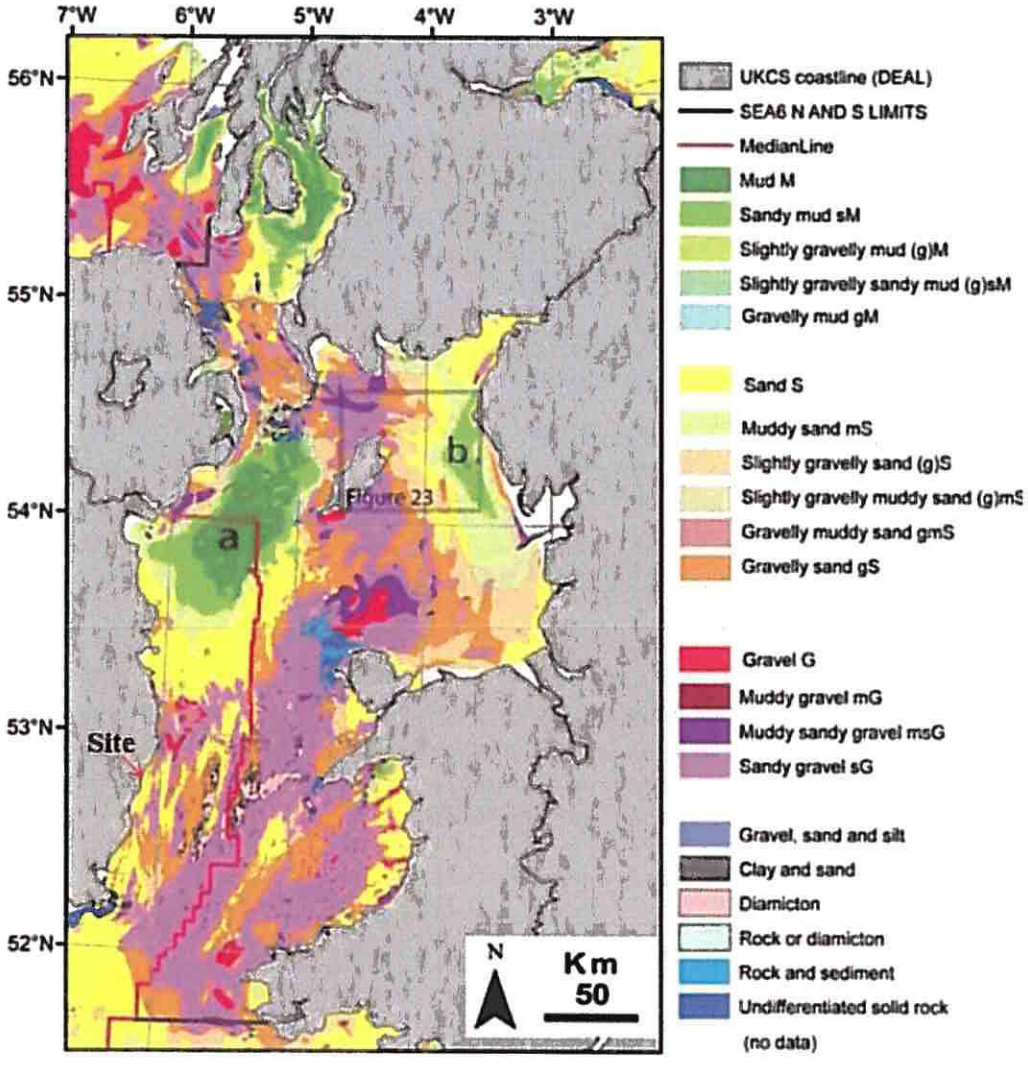

Figure 7: Extract from BGS series regional 1:250000 scale maps of seabed sediments

5.2 Onshore Subsoil

The subsoil geology map of the area indicates that on the landside the overburden geology is comprised predominantly of Limestone till (of Carboniferous age) within a matrix of Irish Sea Basin origin (Irish Sea Till).

This material was deposited during the Ice Age (Quaternary; approximately 1.6 million years ago (mya) to the present) with the material deposited from the ice sheets. This material is known locally as Macamore Clay. It is labelled on the Teagasc Subsoil Map as shown in Figure 8 as Macamore dense Drift of Irish Sea Origin.

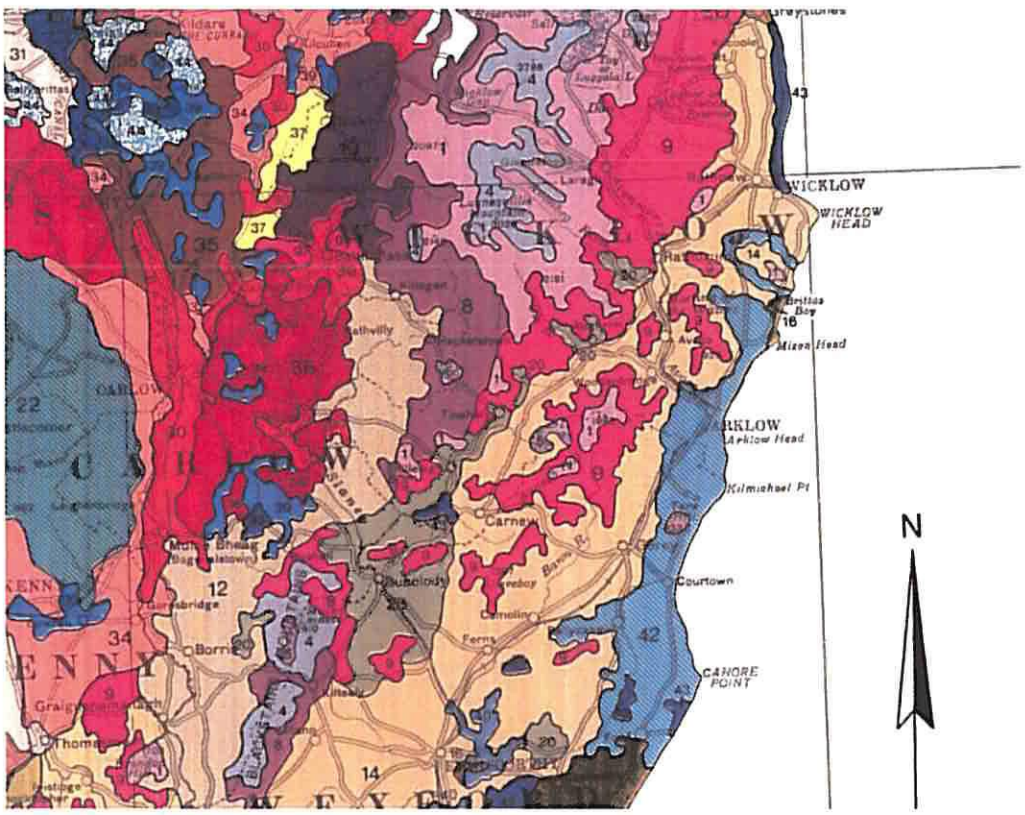

Figure 7: Extract from Teagasc General Soil Map

6 Summary and Conclusions

The preliminary desk study suggests a geological profile of sand overlying possible clay on weak meta-sediments at the location of the proposed Clogga Head development. The desk study therefore supports the assumptions of ground conditions comprising sand made by Irish Mussel Seed Company in assessing anchor capacity

While Irish Mussel Seed Company demonstrate that sand is sufficient to achieve the proof loads of the proposed anchors, the possible presence of stiff clay would increase the capacity of the anchor allowing a greater confidence in the effectiveness of the system.

It should also be noted that additional assurance in the anchor capacity is achieved upon installation of the anchor as a proof load is applied to every anchor during the installation process.

7 References

Geological Survey of Ireland (GSI) (1995), *Geology of Carlow –Wexford, Sheet 19*, 1:100,000 Bedrock Geology Map

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Admiralty Tide Tables Volume 1, UK Hydrographic Office

Carnsore Point to Wicklow Head Admiralty Chart Volume 2013, UK Hydrographic Office.

Federal Insitute for Geoscience and Nateural Resouces (BGR) 5M Geological Units –Offshore

British Geological Survey Series Regional 1:1250000 Scale Maps of seabed sediments.

Ross J.D.L, "Arklow Rock: A shifting-bed Model Investigation" TCD, 195

Teagasc General Soil Map

Arklow Harbour Disposal At Sea, Wicklow County Council, 2013

Google Maps, Aerial Photograph, 2014