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INTRODUCTION

5.1 This Environmental Impact Statement (EIS) evaluates the regional and local geological conditions, and assesses the impact that quarrying will have on the geology of the area and any other geological aspects of the further development of the quarry. It is based on detailed examination of the existing quarry and its surroundings and was prepared by EurGeol Dr. John Kelly PGeo, MIMMM, MIQ in accordance with the guidelines on Geology in Environmental Impact Statements issued by the Institute of Geologists of Ireland.

BASELINE STUDY

OUTLINE

5.2 Information on the solid and drift geology of the Huntstown area and its surrounds was collated and evaluated. Subsequent to this data compilation and review site visits were undertaken to review the solid and drift geology in the existing quarries and adjacent areas.

5.3 A drilling program was carried out in July 2010 to install six groundwater monitoring wells. Rock chip samples from this drilling were collected and have been examined to assist in assessing the geology in the Huntstown area. Borehole locations are shown on Figure 5.4 and borehole logs are presented in Section 6 of this EIS.

BASELINE STUDY METHODOLOGY

5.4 The following activities were undertaken to allow a geological assessment to be completed:

- An examination of available geological information
- Examination of GSI 1:100,000 geology map sheets 13 and 16
- Review of available geological information and literature
- Review of groundwater monitoring well drilling results
- Site inspection

REGIONAL GEOLOGY

Soils

5.5 Teagasc soil mapping shows the Huntstown site to be underlain by renzinas and lithosols and grey-brown podzolics and brown earths. There is a significant amount of made ground on the site which is not shown in the Teagasc mapping. (Figure 5.1). Due to the ongoing extractive operations and installation of plant and infrastructure, little areas of original soil remain.

Quaternary Geology

5.6 Teagasc sub-soil parent material mapping shows the Huntstown site to be underlain by bedrock at, or close to, surface and glacial tills derived from Carboniferous limestones (Figure 5.2).

Bedrock Geology

5.7 The GSI 1:100,000 geology map sheets 13 and 16 shows a complex geology (Figure 5.2). The site is underlain by the Malahide Formation in the southern part of the site. This is overlain to the northwest by Waulsortian Limestones of the Feltrim Limestone Formation which is, in turn, overlain to the northwest by the Tober Colleen Formation. The Tober Colleen Formation is in faulted contact with the Malahide Formation to the northwest, the Malahide Formation in this area reverse faulted to the south over the Tober Colleen.

LOCAL GEOLOGY

Introduction

5.8 There are currently three main areas at Huntstown where extraction is taking place, or has taken place in the past (Figure 5.4). These are referred to in turn as the North, Central and South Quarries. The extensive exposure in these working areas, in conjunction with information from the ground water well drilling, allows a reasonable assessment of the distribution of different lithological formations and the structure of the site to be made.

5.9 The geological sequence at Huntstown was investigated in detail by Jones et al. (1988) although at that time development the current South Quarry had not commenced. The sequence in the Huntstown area determined by Jones et al. is presented in Table 5.1 below.

Table 0-1
Lithological Sequence of the Formations present in the Huntstown Quarry area, partly based on Jones et al. 1988

FORMATION	MEMBERS	Estimated thickness	Description
LUCAN FORMATION		250m at Huntstown? 1000m+ Regionally	Dark fine-grained limestone and thin shales
TOBER COLLEEN FORMATION		100 – 200m?	Shales and dark limestones
FELTRIM LIMESTONE FORMATION (WAULSORTIAN)		200 – 250m	Pale-grey micritic sparry limestones
MALAHIDE LIMESTONE FORMATION	**Barberstown Nodular Member**	84m	Nodular limestones and shales
	Dunsoghley Massive Crinoidal Member	47m	Massive crinoidal limestones
	Huntstown Laminated Member	40m	Laminated coarse limestones
	St Margarets Banded Member	86m	Interbedded shales and limestones
	Swords Argillaceous Bioclastic Member	>860m	Variable. Massive clean limestone units interbedded with banded limestone/shale units and argillaceous bioclastic limestones. Mudstone-dominated units have also been recorded
	Turvey Micrite Member	40m	Micritic limestones and thin shales
	Lower Limestone Shale Unit	>30m	Limestone and shale

Soils and Superficial Deposits

5.10 Soils and superficial deposits have been entirely stripped from the footprint of the current and previous extraction areas and only minimal movement of soil and superficial deposit material is anticipated.

Bedrock Geology

5.11 The South Quarry is developed within limestones of the Malahide Formation which dip steeply to the north in the eastern part of the quarry and to the northwest in the western part of the quarry. The limestones are dominated by well-bedded limestones with minor shales. Banded, interbedded limestones and shales are exposed in the northwestern corner of this extraction area.

5.12 The Central Quarry is not currently being worked and is used as a construction and demolition recycling facility. The quarry is developed in pale micritic Waulsortian limestones of the Feltrim Limestone Formation. The contact between the Waulsortian limestones and the overlying Tober Colleen Formation is exposed in the sides of the roadway accessing the Central Quarry from the north

5.13 The North Quarry is developed in a sequence of well-bedded limestones and academic research on the fossil fauna of the sequence exposed indicates that this quarry is also developed within sub-Waulsortian limestones of the Malahide Formation. The sequence becomes shale dominated to the northwest as seen in borehole GW04 and in the upper part of the faces in the extreme northwest corner of the quarry.

5.14 From inspection of the existing extraction areas, it is apparent that future development at Huntstown quarry will continue to work the same limestone deposits as are presently being worked.

Structure

5.15 The sequence at Huntstown dips steeply to the north or northwest (Figures 5.4 and 5.5), with recorded dip values varying from 23° in the east of the South Quarry. The sequence in the west of the South Quarry dips at 44° to the northwest. The sequence in the Central Quarry is recorded as dipping at 54° to the northwest. The sequence in the North Quarry dips reasonably uniformly to the northwest or north-northwest, with dip values varying from 30° to 55°.

5.16 As the limestones exposed in the North Quarry have been dated as being older than, and therefore stratigraphically below, the Waulsortian Limestones of the Central Quarry, there must be a significant reverse fault present between the central and southern quarries. A probable fault plane has been identified in the immediate southern part of the North Quarry where the main access road enters this area. This is interpreted as part of the trace of the

reverse fault and the trace of the reverse fault has therefore been located on the basis of this exposure.

5.17 The Tober Colleen Formation is interpreted as being approximately 200m thick in the Huntstown area and the steep dip suggests that the sub-crop area of the Tober Colleen Formation would be approximately 100m in width from the exposure of the basal contact of this unit in the Central Quarry access road. In light of this, it would be expected that the area between the top of the Tober Colleen and the reverse fault should be underlain by limestones of the Lucan Formation which lies above the Tober Colleen in the sequence. Rock exposures in the proposed western quarry were examined but determination of these rocks as being Lucan or Malahide Formation can only be undertaken by biostratigraphic analysis.

5.18 The rocks are well jointed. The dominant joint-set trends roughly N-S and are sub-vertical, typically dipping between 87° east and 87° west. These joints are frequently associated with calcite or calcite dolomite veins. In some locations they may be solutionally enlarged and have brown clay fills which are rare in the northern and southern quarries, but are more common in the Central Quarry.

5.19 The rock is strong to very strong and weathering is rarely significant more than a few decimetres below the rock surface.

Geological Heritage

5.20 Consultations have been made with the Geological Survey of Ireland in relation to the geological heritage aspects at Huntstown. The contact between the Waulsortian Limestones of the Feltrim Limestone Formation and the Tober Colleen Formation, exposed in the roadway into the Central Quarry, has been listed as part of Irish Geological Heritage Programme 8.

5.21 The IGH Programme staff have visited the relevant parts of Huntstown Quarry and their comments are presented in Appendix 5-A. Roadstone Wood Ltd. will ensure that the relevant geological section and rock exposure will be maintained.

MINERALOGY AND ENGINEERING CHARACTERISTICS

Introduction

5.22 Crushed rock, and the overlying sand & gravel currently extracted from Huntstown Quarry are used for a wide range of aggregate uses including:-

- Concrete products
- Readymix concrete
- Road sub-base, base and blacktop (tarmacadam) surfacing
- General aggregate, fill etc.

Aggregate Testing

5.23 A range of aggregate test results are undertaken by Roadstone Wood on aggregates produced at Huntstown. Aggregate testing was undertaken by accredited laboratories in Ireland and the UK.

5.24 Aggregate tests undertaken include:

- Fines Content
- Flakiness Index
- Micro-Deval
- Los Angeles Test
- Polished Stone Value
- Aggregate Abrasion Value
- Particle Density and Water Absorption
- Magnesium Sulphate Test
- Drying Shrinkage
- Chloride Content
- Acid Soluble Sulphate
- Total Sulphur

5.25 From the results of the regular aggregate testing programme, aggregates produced at Huntstown comply with the quality requirements outlined in:

- Aggregates for Bituminous Mixtures and Surface Treatments for Roads, Airfields and other Trafficked areas to :EN 13043 (S.R.17)
- Aggregates for Concrete to EN 12620 (S.R. 16)

KARSTIFICATION

Introduction

5.26 The presence, nature and extent of any karstification at Huntstown Quarry has been assessed. Inspection of the existing quarry revealed a number of minor solutionally enlarged and clay-infilled joints, particularly in the Central Quarry. One particularly wide joint is exposed in the eastern part of the South Quarry where the joint has been enlarged to approximately 0.5m to 2.0m in width. This feature appears to pinch rapidly to the south and would be expected to pinch with depth. The quarry manager reports that these features do not significantly interfere with quarrying operations.

5.27 A thin zone of epikarst is developed immediately below the contact between bedrock and overburden. In the existing quarry faces, this epikarst zone extends for only 1.0m into the bedrock and is characterised by slight enlargement of joints by solution.

5.28 No significant karstification was observed in the ground water boreholes.

ASSESSMENT OF IMPACTS

DIRECT IMPACTS

5.29 The nature of the development will entail blasting and removal of bedrock. The quarry footprint will not be significantly extended so no large-scale removal and placement of soil and overburden is anticipated. Thus there will be a direct and irreversible impact on the existing in situ bedrock.

INDIRECT IMPACTS

5.30 The development will not have an indirect impact on the geological aspects of the environment outside the footprint of the quarry area. Groundwater aspects of the quarry development are assessed in Section 6 of this EIS.

SOILS

5.31 The quarry development will have a long-term land take of c.55.9 hectares. Any topsoil / subsoil and overburden material will be removed and then, in conjunction with previously removed materials will be:

- Used to create landscaped screening berms around the perimeter of the site.
- Topsoil to be used for the restoration of the site when infilled back to original ground level as detailed in the site restoration plan in Figure 2-4.

5.32 To limit the effects of erosion on any soil materials the following measures are adopted.

- Stripping, removal and moving of soils will not take place during periods of prolonged dry weather.
- Where ever these materials are placed in either permanent or temporary locations, an angle of repose of no greater than 1: 1.5 will be used. This is considered the maximum acceptable slope to limit excessive erosion of the material.
- Screening berms will be planted / vegetated.
- Re-handling of soils will be minimised as much as possible in order to preserve the integrity of the topsoil material. This is also an economically prudent practice.

GEOLOGY

5.33 Quarrying of aggregate material, by definition, requires the excavation and removal of rock material, thereby producing a permanent impact on the local bedrock environment within the quarry footprint.

5.34 The quarry restoration scheme will ultimately allow the site to be returned to a condition whereby there will be negligible residual impact on the surrounding environment due to the removal of rock material within the quarry.

5.35 The quarry restoration scheme will includes provision for retaining exposures of the contact between the Waulsortian and Tober Colleen Formation, for geological heritage and education purposes as recommended by the Geological Survey of Ireland.

REFERENCES

- Jones, G.Ll., Somerville, I.D. and Strogen, P. 1988. The Lower Carboniferous (Dinantian) of the Swords Area: Sedimentation and Tectonics in the Dublin Basin, Ireland. Geological Journal 23, p221 – 248.
- McConnell, B.J., Philcox, M.E., Sleeman, A.G., Stanley, G., Flegg, A.M. , Daly, E.P. & Warren, W.P. 1994. Geology of Meath. Geological Survey of Ireland Bedrock Geology 1:100,000 Scale Map Series, Sheet 13.
- McConnell, B.J. and Philcox, M.E. 1994. Geology of Kildare - Wicklow. Geological Survey of Ireland Bedrock Geology 1:100,000 Scale Map Series, Sheet 16.

FIGURES

Figure 5.1
Soils Map

(Soil type distribution in the Huntstown and surrounding area. From Teagasc soil mapping)

Figure 5.2
Subsoils Map

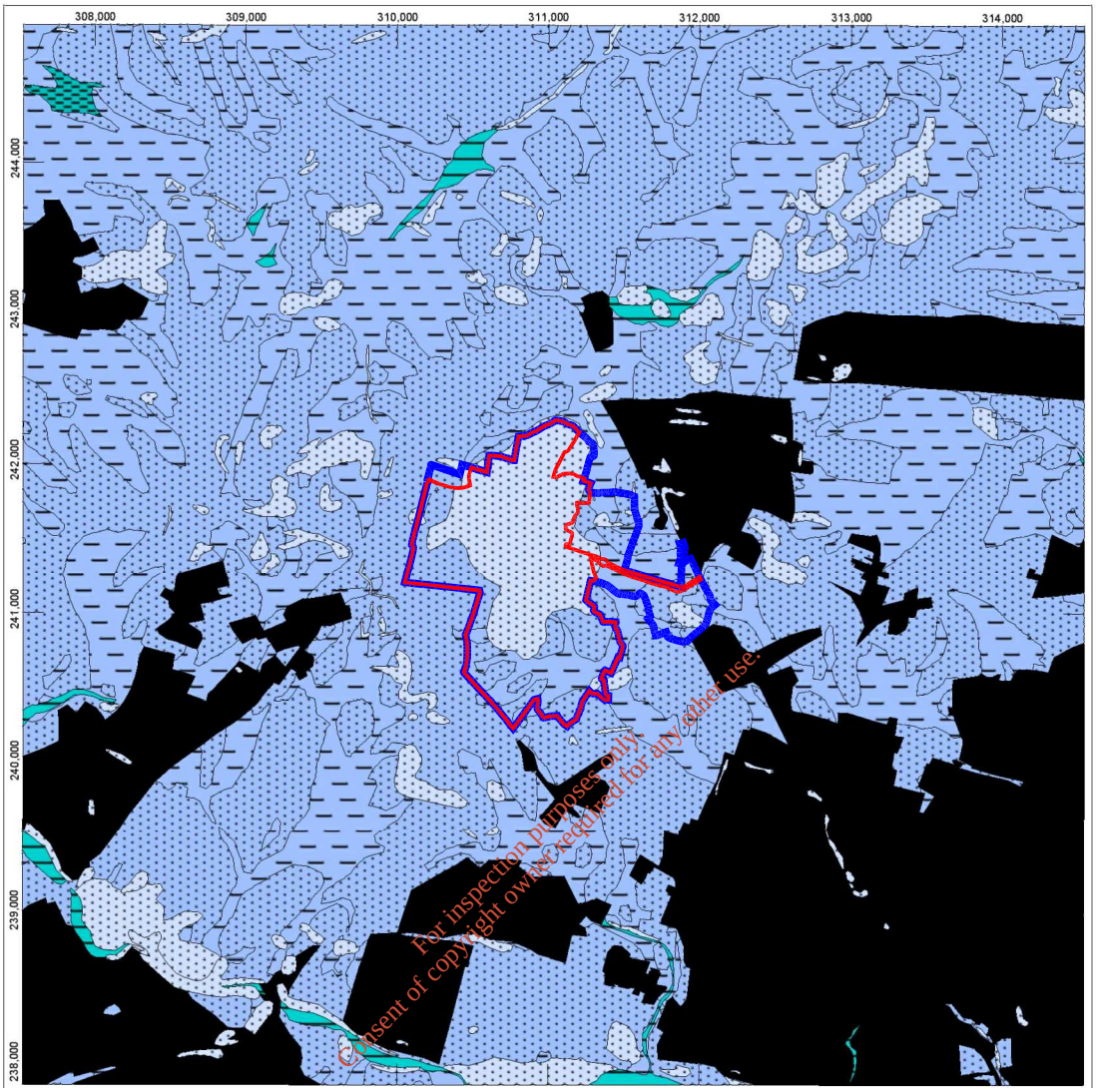
(Drift geology of Huntstown and surrounding area. From Teagasc sub-soil parent material mapping)

Figure 5.3
Regional Geology

(Solid Geology of Huntstown and surrounding area. From GSI 1:100,000 Sheets 13 and 16)

Figure 5.4
Detailed Geology Map

Figure 5.5
Geological Cross-Section



Teagasc Soil Mapping
IFS Soil Type

- Lacustrine Sediments
- Alluvium - Mineral
- Grey Brown Podzolics and Brown Earths
- Renzinas and Lithosols
- Surface and Ground Water Gleys derived from calcareous parent
- Made Ground

ROADSTONE WOOD LTD. LANDHOLDING (c. 211 ha)

PLANNING APPLICATION AREA (c. 167.5 ha)

1. EXTRACT FROM TEAGASC-SUB SOIL PARENT MATERIAL MAPPING

0 500 1000 1500 2000m 3000 4000 5000

Metres
1:50,000

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REGIONAL SOILS MAP

FIGURE 5-1

Scale
1:50,000 @ A4

Date
FEBRUARY 2012

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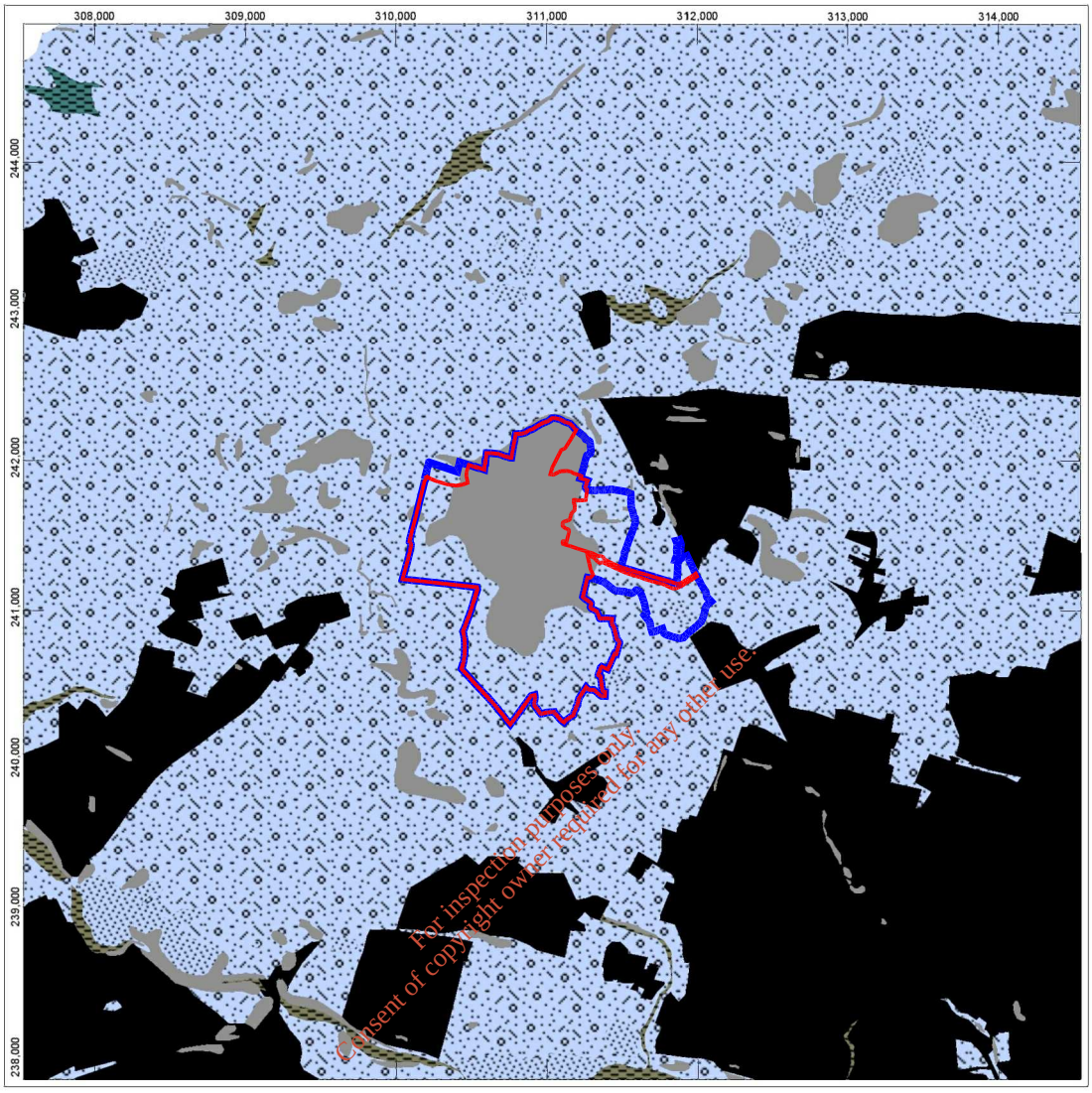

Teagasc Subsoil Mapping
Superficial Deposit Type

- Alluvium
- Lacustrine Sediments
- Sand and Gravel - Carboniferous Limestones
- Till - Carboniferous Limestone Clasts
- Outcrop & Subcrop
- Made Ground

ROADSTONE WOOD LTD. LANDHOLDING (C. 211 ha)

PLANNING APPLICATION AREA (c. 167.5 ha)

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0 500 1000 1500 2000m 3000 4000 5000

Metres
1:50,000

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REGIONAL SUBSOIL MAP

FIGURE 5-2

Scale
1:50,000 @ A4

Date
FEBRUARY 2012

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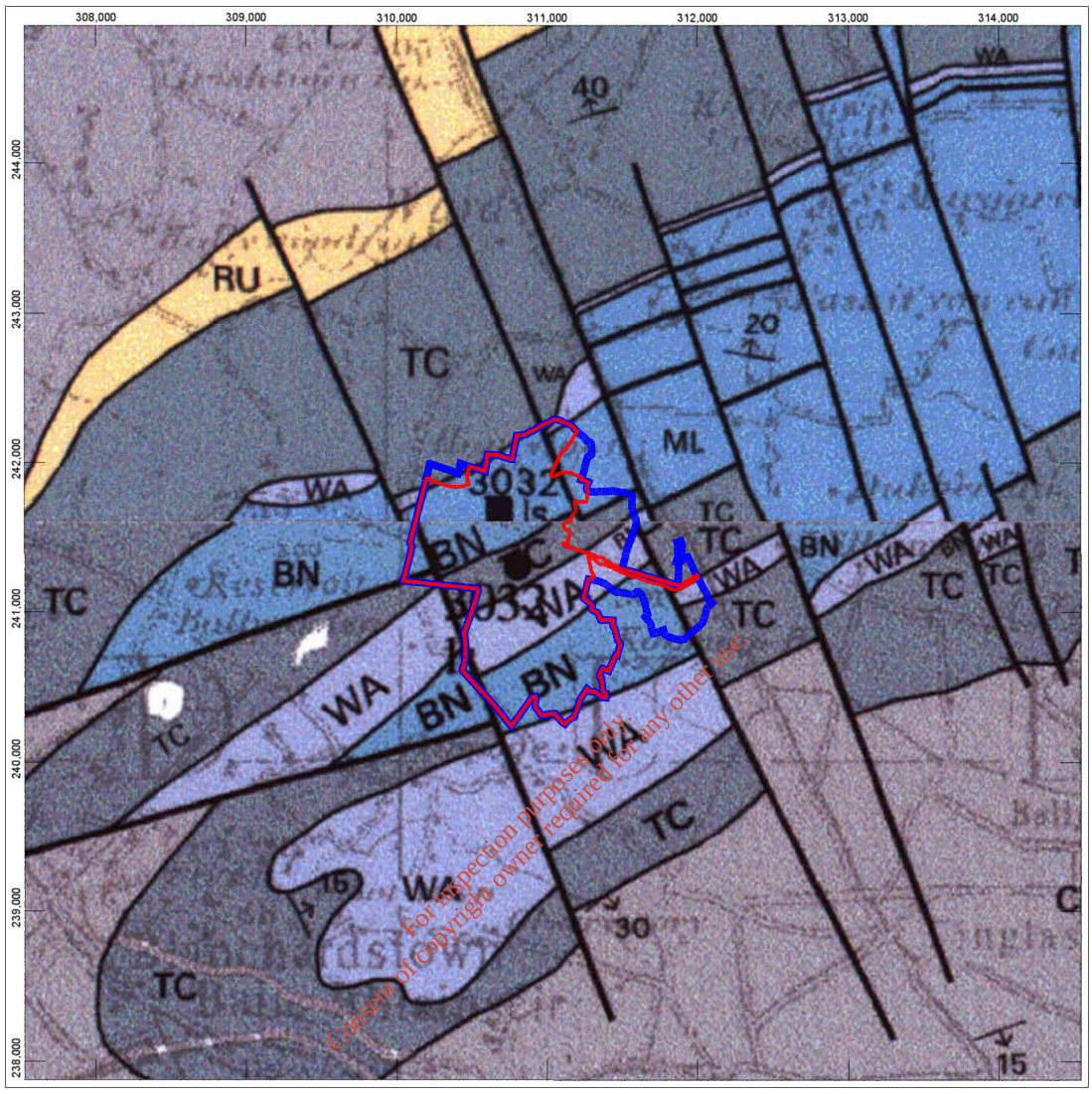

N

W E

S

LU	**Lucan Formation**	Dark limestone & shale (Calp)
RU	**Rush Conglomerate Formation**	Conglomerate, shale, limestone
TC	**Tober Colleen Formation**	Calcareous shale, limestone conglomerate
WA	**Waulsortian Limestones**	Massive unbedded lime-mudstone
ML	**Malahide Formation**	Argillaceous bioclastic limestone, shale (Also Known as Boston Hill Formation (BN)

ROADSTONE WOOD LTD. LANDHOLDING (C. 211 ha)

PLANNING APPLICATION AREA (c. 167.5 ha)

1. EXTRACT FROM 1:50,000 O.S DISCOVERY MAP NO. 50

0 500 1000 1500 2000m 3000 4000 5000

Metres
1:50,000

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REGIONAL BEDROCK GEOLOGY MAP

FIGURE 5-3

Scale	Date
1:50,000 @ A4	FEBRUARY 2012

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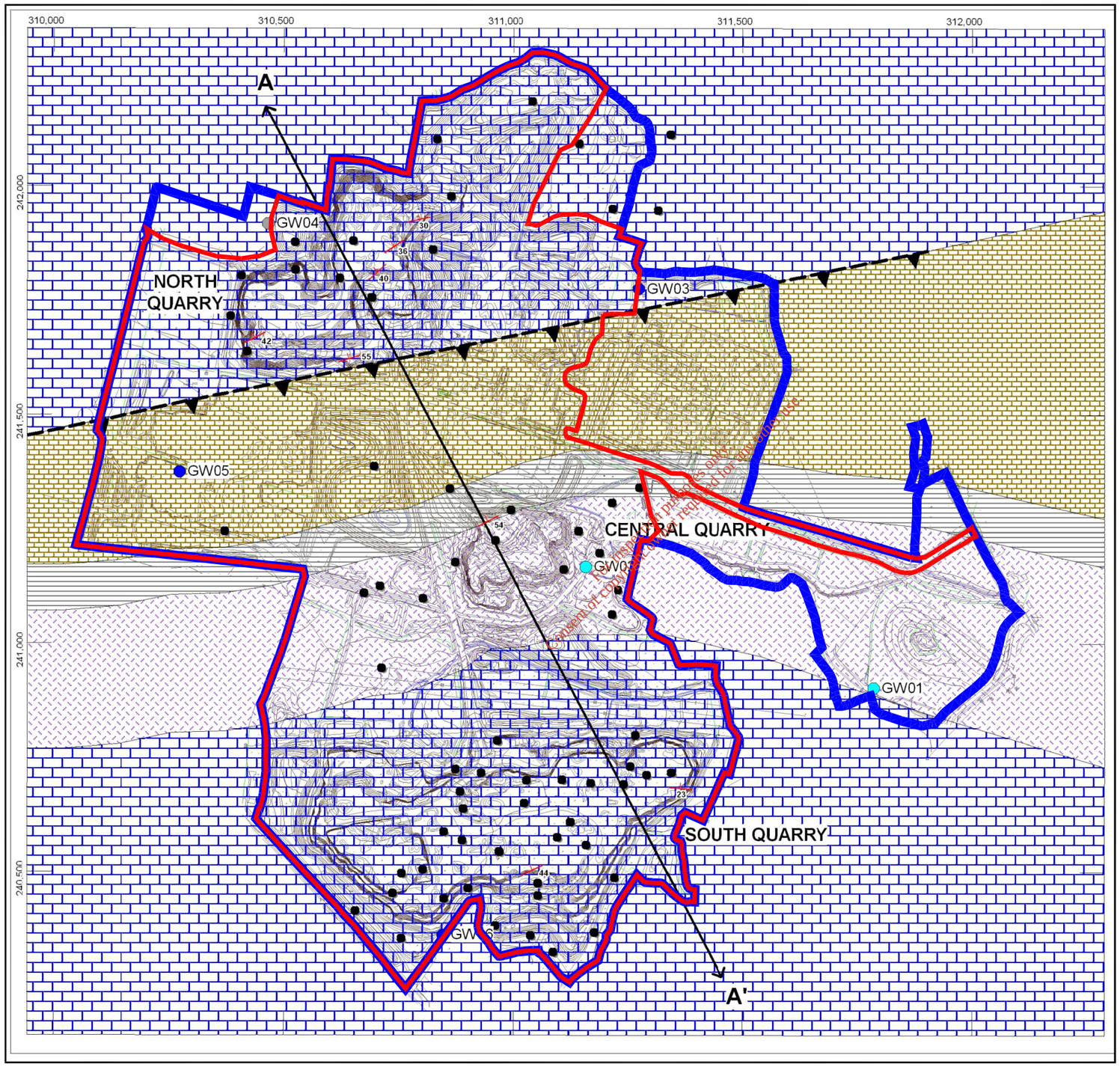

0 100 200 300 400m 600 800 1000

Metres
1:10,000

N
W E
S

NOTES

1. EXTRACT FROM 1:50,000 O.S DISCOVERY MAP NO. 50

2. ORDNANCE SURVEY IRELAND LICENCE NO. SU 0000712 (C) ORDNANCE SURVEY & GOVERNMENT OF IRELAND

LEGEND

ROADSTONE WOOD LTD. LANDHOLDING (C. 211 ha)

PLANNING APPLICATION AREA (C. 167.5 ha)

SECTION LINE A-A'

Huntstown Quarry Bedrock Geology

- Lucan Formation
- Tober Colleen Formation
- Feltrim Limestone Formation (Waulsortian)
- Malahide Limestone Formation

Huntstown Quarry Groundwater Wells

Collar Lithology

- Dark Limestone
- Limestone and Shale
- Feltrim Limestone fmn (Waulsortian)

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DETAILED LOCAL BEDROCK GEOLOGY MAP

FIGURE 5-4

Scale
1:10,000 @ A3

Date
FEBRUARY 2012

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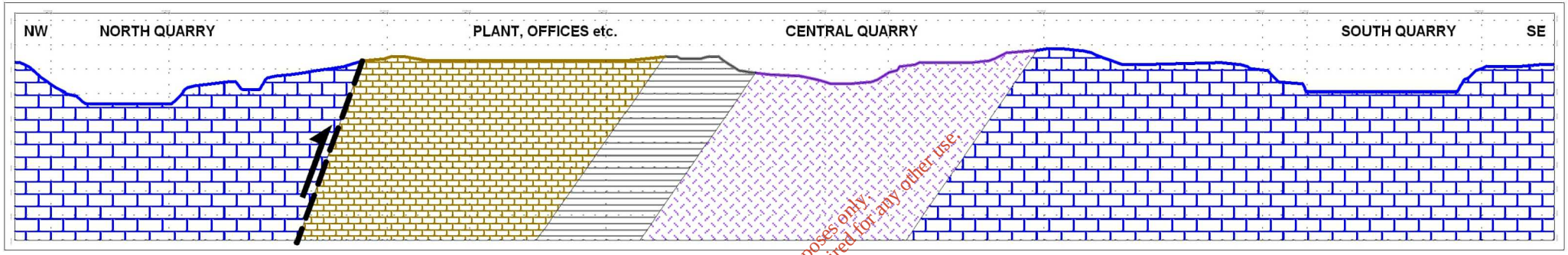

Huntstown Quarry Bedrock Geology

- Lucan Formation
- Tober Colleen Formation
- Feltrim Limestone Formation (Waulsortian)
- Malahide Limestone Formation

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GEOLOGICAL CROSS-SECTION

FIGURE 5-5

Scale	Date
1:6,000 @ A4	FEBRUARY 2012

00180.00011.18.5-5.R0.GEOLOGICAL CROSS-SECTION.dwg

PLATES

Plate 5-1. Typical limestones exposed in the western face of the North Quarry. Note steep dip to northwest and well-bedded nature of the limestones.

Plate 5-2. Northwestern area of North Quarry immediately northeast of borehole GW04. Note shales dominating sequence in upper part of quarry face.

Plate 5-3. Huntstown Central Quarry. Exposure of the contact between the Waulsortian limestones of the Feltrim Limestone Formation to right and Tober Colleen Formation to left. Contact marked by arrow.

Plate 5-4. Typical limestone sequence exposed in southwestern part of the South Quarry

APPENDICES

Appendix 5-A
Letter from the Geological Survey of Ireland (GSI) in relation to Geological Heritage Issues

Shane McDermott

From: Sarah Gatley [Sarah.Gatley@gsi.ie]
Sent: 29 June 2011 18:07
To: John Kelly; Shane McDermott; Tim Paul
Cc: Sophie Preteseille; Parkes, Matthew
Subject: RE: EIS Huntstown Quarry_GSI submission

Re: Roadstone Wood Ltd – Huntstown Quarry

Dear John,

Following on from the site visit on 13th June 2011 to Huntstown Quarry, arranged with Roadstone Wood Ltd and SLR Consulting, the Irish Geological Heritage and Planning Programme of the Geological Survey of Ireland (GSI), would like to make the following comments, in conjunction with the original comments made by email on 4th may 2011 (see below):

The relevant sections of Tober Colleen Formation overlying Waulsortain, are exposed along both sides of the access road between the plant offices (North Quarry) and the Central (formerly South) Quarry, which is now used as a re-cycling facility. A barrier or 'berm' of waste concrete protects passing quarry vehicles from the eastern scarp of interest, and thereby obscures a complete view of the section. However, it also serves to 'protect' the section on this side from inadvertent damage by quarry traffic.

The GSI understands that the area of geological interest has been documented in re-mapping of the quarry area in the current EIS preparation, by SLR (June 2011).
Whilst GSI would ideally like to see that Roadstone Wood Ltd makes provision in its restoration plan for the preservation of, and access to, a representative section of this significant part of Ireland's Carboniferous stratigraphy, it understands that there is a 'backfilling' requirement in the plan at the end of quarry life but that no disturbance of the sections is envisaged in the mid-term future.

The GSI appreciates the co-operation of Roadstone Wood Ltd and SLR Consulting in the recognition of the geological heritage importance of the sections, and understands that Roadstone is amenable to facilitating future access by accredited geologists, subject to prior notice and due consideration to safety aspects.

Kind regards
Sarah

Dr Sarah Gatley
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Website: www.gsi.ie
Latest GSI Newsletter: www.gsi.ie/newsletters/

From: Sarah Gatley
Sent: 04 May 2011 14:57
To: 'smcdermott@slrconsulting.com'; 'tpaul@slrconsulting.com'
Cc: 'jkelly@slrconsulting.com'; Sophie Preteseille
Subject: EIS Huntstown Quarry_GSI submission

Dear Shane,