

## SECTION 5: SOILS & GEOLOGY

### 5.1 INTRODUCTION

#### 5.1.1 Purpose of Study

This study presents available information on the soils and geology within and immediately beyond the site of the proposed inert waste recovery facility to be operated by Roadstone Ltd. at Milverton Quarry, Skerries, Co. Dublin, together with an interpretation of the existing local geological environment in the vicinity of the site. It will identify how this environment will be impacted by the proposed waste recovery facility and, where possible, will identify how these impacts may be mitigated.

#### 5.1.2 Difficulties Encountered in Compilation

This impact assessment is based on a visual inspection of the site, published geological maps and available ground investigation data, principally a trial pit and borehole survey undertaken at the site in November 2008. No particular difficulties were identified in preparing this report.

#### 5.1.3 Personnel

This study of soils and geology was undertaken and prepared by:

- EurGeol Peter Glanville PGeo, B.A., Ph.D., Geomorphologist, SLR Consulting Ltd.
- Mike Kelley, B.Sc., M.Sc., M.I.E.I., Geotechnical Engineer, SLR Consulting Ltd.

#### 5.1.4 Consultations

In undertaking this study, documentation and information was obtained from the following bodies:

- Teagasc;
- Quaternary Section, Geological Survey of Ireland, Haddington Road, Dublin 4;
- Bedrock Geology Section, Geological Survey of Ireland, Haddington Road, Dublin 4; and
- Groundwater Section, Geological Survey of Ireland, Haddington Road, Dublin 4.

Site visits by SLR personnel were made in 2008, 2009, 2012 and 2014.

### 5.2 RECEIVING ENVIRONMENT

#### 5.2.1 Outline of the Baseline Study

In preparing this soil and geology chapter, the study area was taken to be the entire landholding of Roadstone Ltd. at Milverton Quarry, Skerries, Co. Dublin. The baseline study was prepared using previously published regional geological and geomorphological data, together with ground investigation information obtained from a trial pit and borehole survey undertaken at the application site. Existing exposures of in-situ soil and/or subsoil deposits and rock faces were also visually inspected to assist in the interpretation of ground conditions occurring across the application site.

#### 5.2.2 Soil

Soil is the top layer of the earth's crust. It is formed by mineral particles, organic matter, water, air and living organisms. It is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief and the actions of living organisms over time.

Soils can take thousands of years to evolve and is essentially a non-renewable resource. Soil performs many vital functions. It supports food and other biomass production (forestry, biofuels etc.) by providing anchorage for vegetation and storing water and nutrients long enough for plants to absorb them. Soil also stores, filters and transforms others substances including carbon and nitrogen. It also has a role supporting habitats and serves as a platform for human activity, landscape and archaeology.

The soils surrounding the application site at Milverton are classified as Grey Brown Podzolics, a mineral soil derived from glacial till of Irish Sea origin with clasts of limestone and shale (An ForasTaluntais, 1980). These soils are indicated to have a wide use range of agricultural uses, including tillage and pasture (An ForasTaluntais, 1980).

Topsoil (the upper layer of soil capable of sustaining vegetation and crop growth) and subsoil was previously stripped across the application site in order to facilitate quarry development. It is currently stockpiled as hummocky mounds in the northern part of the quarry.

### 5.2.3 Quaternary Geological and Geomorphological Setting

Quaternary geology comprises the study of subsoils deposited or formed during the last 2 million years, termed quaternary subsoils. The two main types of quaternary subsoil in Ireland are glacial till, deposited at the base or margins of ice sheets, and sand and gravel, whose deposition is generally associated with the melting of ice sheets, at the end of periods of glaciation. Other extensive quaternary soils in Ireland include basin and blanket peat, river alluvium and estuarine deposits.

During the maximum (peak) of the last (Midlandian) glaciation approximately 24,000 to 20,000 years ago, a large ice sheet covered most of central Ireland, while another ice sheet pushed down the Irish Sea basin from Scotland. The Irish Sea Basin ice sheet pushed up onto the Irish coastline between Louth and Wexford, depositing geological material which previously occurred across the Irish Sea Basin, as it did so.

### 5.2.4 Regional Quaternary Geology

The 1855 1:63,360 scale (1") Geological Map of the Swords area (Sheet 102) published by the Geological Survey of Ireland (GSI) indicates that the quaternary soils in the vicinity of the application site comprises 'drift deposits, chiefly limestone gravel'.

The Teagasc Subsoil map (2004) indicates that the application site and an area to the south and east, at the top of the hill, have bedrock outcropping at the surface. The surrounding area is generally indicated to be underlain by glacial till material of Irish Sea Basin origin, refer to Figure 5.1. Quaternary subsoil east of the application site and the rail line comprises sand and gravel of Lower Palaeozoic sandstone and shale origin. Alluvium is indicated to occur along the Mill Stream located approximately 0.5km north east of the site.

Any glacial deposits which may have previously overlaid the limestone bedrock across the application site have been completely removed and are currently stockpiled in the northern part of the site and around the quarry perimeter. It is understood that some of the excavated glacial deposits were re-used to form a level working platform beneath the existing yard and readymix plant area on the north western side of the site. Some excavated materials were also used to construct the existing access ramp to the quarry floor.

### 5.2.5 Regional Solid Geology

The 1:100,000 scale solid geology map (*Geology of Meath, Sheet 13*) published by the Geological Survey of Ireland indicates that the regional bedrock geology at the site comprises well bedded, bioclastic limestone (with oolite in the lower part) of the Holmpatrick Formation. This formation is one of several which makes up the Milverton Group which is believed to be of Carboniferous (Viséan) age (approximately 330 million years old). Rock strata within this formation are generally indicated to dip in a southerly direction. An extract from the bedrock map is reproduced as Figure 5.2.

The quarry void extends to between 8m and 12m below sea level. At present there is c. 10m of water in the quarry void and the water level is at approximately -2mOD. When the quarry was operational, there were a number of small groundwater seepages on the quarry faces, and both direct precipitation and influent groundwater was pumped out from a sump on the quarry floor.

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### 5.2.6 Available Ground Investigation Information

A ground investigation was undertaken at the application site in November and December 2008. The investigation comprised a series of trial pits and boreholes to investigate geology at the site.

A total of six trial pits were excavated at Milverton, designated MTP1, MTP2, MTP3, MTP4, MTP5 and MTP6. The locations of the trial pit excavations are indicated on Figure 5.3. While the trial pits extended up to 2.5m below ground level, they were generally very shallow. The trial pit logs and photographs of these excavations are provided in a factual ground investigation report reproduced in Appendix 5.1.

Trial pits MTP1 and MTP2 are located on the floor of the quarry and indicate up to 0.9m of Made Ground (comprising crushed rock aggregate) over bedrock. The rock aggregate material has been subject to compaction by site traffic. Trial pits MTP5 and MTP6 were conducted on the upper benches of the quarry and encountered limestone bedrock at or close to the surface.

Trial pits MTP3 and MTP4 were conducted around the existing site infrastructure area and encountered Made Ground (comprising crushed rock fines and/or rock aggregate) overlying gravelly clay. No bedrock was encountered in these trial pits, but an examination of the exposed faces in the quarry void indicates that the gravelly clay material underlying the site infrastructure area may be up to 4m to 5m thick.

Two subsoil samples were taken at the site for baseline chemical analysis, one sample from trial pit MTP4, at the existing shed / work yard area, and the other from trial pit MTP5, located immediately to the west of the shed / work yard area, refer to Figure 5.3.

Three groundwater monitoring wells (BH1, BH2 and BH3) were subsequently installed across the application site in December 2008, at locations indicated in Figure 5.3. The monitoring wells were drilled using rotary techniques, and as a result, it was only possible to obtain general descriptions of the Quaternary subsoil deposits encountered during well drilling. In general, the monitoring wells encountered

Subsoils encountered during drilling are described as follows:

- MADE GROUND (sandy gravelly clay);
- Sandy gravelly CLAY (Glacial Till); and
- Grey fine to medium grained LIMESTONE.

Monitoring well construction records are presented in the groundwater well installation report, reproduced as Appendix 6.1.

### 5.2.7 Geological Interpretation: Ground Conditions

An interpretation of the general geological profile across the application site at Milverton has been inferred on the basis of the available ground investigation information.

Site inspection and the available ground investigation information indicate that glacial till material which previously occurred across the application site has been striped and stockpiled across the site. Across the area where the glacial till has been removed, the underlying limestone rock is exposed. Some stripped glacial till has been re-used as fill material beneath the readymix plant and work yard area and also in the construction of the ramp to the quarry floor. Within the quarry, some recovered soil and subsoil material has been placed in the south-eastern corner of the void space.

### 5.2.8 Geohazards

The site at Milverton is underlain by carboniferous limestone of the Holmpatrick Formation. There are no karst solution features identified at, or immediately around, the site on the GSI's Karst Database. Only a small amount of groundwater seeps into the quarry excavation. Given that the floor of the quarry lies almost 50m below ground level and at approximately -12mOD, this suggests that the surrounding rock is relatively tight and impermeable. After several years without pumping at the site, the water level in the quarry void is still only 10m deep (at -2mOD).

Given the gently undulating nature of the topography around the site and the fact that the underlying subsoil generally comprises glacial till, it is considered that the area around the application site is unlikely to be susceptible to any landslide hazard. No historical landslides are identified in the surrounding area by the Irish Landslides Working Group (GSI, July 2006).

The OPW flood database ([www.floodmaps.ie](http://www.floodmaps.ie)) indicates there is no recorded flooding in the immediate vicinity of the site at Milverton. Given the elevated nature of the site the risk of flooding locally from a surface watercourse or the sea is considered to be very low.

The exposed soil and subsoil above the quarry face are heavily vegetated and it is unlikely that there is any soil erosion from these faces. At the northern end of the quarry, where glacial till overburden has been stripped, a face into the till material is exposed, however there is little evidence of any weathering or soil erosion at the exposed face.

### 5.2.9 Geological Heritage

In 2007, the GSI published a report titled 'The Geological Heritage of Fingal' which identified sites of geological importance in Fingal County and recommended their protection as County Geological Sites. While these sites have subsequently been identified as county sites within the development plan, some may yet be designated as proposed Natural Heritage Areas (pNHAs) because of their geological interest from a national perspective. This exercise has not however been undertaken yet.

The quarry at Milverton has been designated under the Geological Survey of Ireland (GSI) Irish Geological Heritage (IGH) Programme as a site of interest under the IGH Theme 8 covering Lower Carboniferous sites, refer to Appendix 5.2.

As noted above, the quarry at Milverton is a designated County Geological Site in the Fingal County Development Plan (2011-2017). Objective GH01 of the County Development Plan is to 'protect and enhance the geological and geomorphological heritage values of the County Geological Sites'; while objective GH02 of the plan is to 'Promote safe and sustainable public access to County Geological Sites where appropriate and feasible subject to the requirements of Article 6 of the Habitats Directive'. In the plan, the Council indicates that it will seek to maintain, and where possible enhance, the geological heritage values of the County Geological Sites and will consult the Geological Survey of Ireland when considering undertaking, approving or authorising developments which are likely to affect.

The fact that the site at Milverton has not been designated a proposed NHA by the National Parks and Wildlife Service suggests that its geological heritage value is not of national importance. Its designation as a County Geological Site would suggest instead that it is more likely to be of local, or at best, regional significance.

The nearest site of geological interest off-site is located approximately 2km to the east-southeast (ESE), at the proposed Natural Heritage Area (pNHA) along the coast between Loughshinny and Rush. The GSI recommends that this entire section of coastline should be designated an NHA on account of some unique exposures of Lower Carboniferous age rocks. It includes six geological formations in chronological order from the youngest in the north to the oldest in the south. It also includes an exposure of a conglomerate turbidite sequence, the only exposure of such rocks in Ireland. Some spectacular geological structures also occur in coastal cliff sections, most notably a chevron folding south of Loughshinny pier.

### 5.2.10 Economic Geology

Historical mapping indicates that there was quarrying activity at the application site back in the late 1800's. More recently in the late 1990's, Roadstone Ltd., acquired the site from another CRH Group Company and continued the quarrying activity and established a readymix facility at the site. Roadstone Ltd. also established a retail paving centre at the site. Quarrying, concrete production and retail centre operations have all been suspended at the application site since late summer 2008.

There is no land available to Roadstone Ltd. at this location to expand the quarry. At the present time, Roadstone expects that the demand for aggregates which was previously met from

Milverton will in future be met by other Roadstone facilities across the Greater Dublin Area, most likely from Huntstown Quarry.

### 5.2.11 Made Ground

No material has been imported to the application site for recovery purposes to date. There is some Made Ground beneath the existing work yard and concrete plant and also along the access ramp to the quarry floor. This Made Ground largely comprises glacial till sourced at the site and/or also some crushed rock fines from aggregate processing activities.

## 5.3 IMPACT OF RESTORATION SCHEME

### 5.3.1 Evaluation of Impacts

The evaluation of impacts on the soil and geology at and in the vicinity of the existing quarry site and proposed waste recovery facility at Milverton is based on a methodology similar to that outlined in the 'Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes' published by the National Roads Authority (2009).

The importance of existing soil and geology attributes discussed previously is assessed in Table 5.1 below:

Attribute	Status / Occurrence	Importance
Geohazards	Erosion of exposed soils on existing slopes.	Low
Geological Heritage	Designated County Geological Site	Medium
Economic Geology	Economic extraction complete at application site.	Low
Agricultural Soils	Productive soil previously removed and stockpiled at the application site. Other soil in vicinity of site used for wide range of agricultural activities.	Low
Made Ground	Crushed rock fines and glacial till materials re-used at the site are of low economic or environmental value. They are free of contamination.	Low

**Table 5.1 Importance of Geological Attributes in vicinity of Application Site**

The significance of the impacts on the soil and geology attributes is assessed in Table 5.2 below:

Attribute	Impact of Proposal on Attribute	Magnitude
Geohazards	Elimination of localised erosion at existing stockpiles. Elimination of risk of slope instability.	Small, positive
Geological Heritage	Loss of the exposed quarry face	Moderate, negative
Economic Geology	No further extraction at the site or sterilisation of potential aggregate resource	Negligible
Agricultural Soils	Restoration of former landform and placement of topsoil / subsoil on completion of backfilling will restore lands to agricultural use.	Small, positive
Made Ground	Importation of soil, stones and possibly small volumes of inert construction and demolition waste introduces a risk of potential soil contamination	Small, negative

**Table 5.2 Significance of Impacts on Soil and Geology**

The restoration of the original ground level will enhance the character of the landscape in the surrounding area, which is located within the area designated Landscape Group 5 (LG5) in the current Fingal Development Plan (2011-2017). On completion of backfilling and restoration, there will be a small improvement in the appearance and form of the nearby hill, a geomorphological feature of moderate importance. The significance of this impact is therefore assessed as being minor and positive.

In the absence of mitigation measures however, the backfilling and restoration of the application site to its original levels would result in the complete loss of rock exposures which are of local geological heritage value and have merited designation as a County Geological Site. This impact were it to arise, would be deemed to be of moderate, negative impact.

The proposed waste recovery activity will ultimately also facilitate the re-establishment of agricultural soil across the application site and its return to agricultural use. As this proposal constitutes a small improvement on an attribute of low importance, this impact is assessed as being minor and positive.

In the absence of any controls, the importation of soil, stones and small quantities of inert C&D waste could introduce a risk of potential soil contamination at the application site. The recent ground investigation did not reveal any evidence of soil contamination at the quarry facility. Assuming the proposed waste recovery facility is run in accordance with best waste management practice, this risk is likely to remain small. Given that the risk of introducing contamination into existing relatively degraded, low value subsoils and/or rock is small to moderate, the significance of this potential impact is assessed as minor and negative.

### 5.3.2 Interaction with Other Environmental Receptors

The potential risks associated with the introduction of contaminated soil when backfilling and restoring the application site could have implications for groundwater quality, were infiltrating rainfall to percolate down through the contaminated backfill materials. This aspect is discussed in more detail in Chapter 6 of the EIS.

When successfully completed however, the proposed backfilling and restoration works will provide an increased thickness of soil and subsoil cover above the existing groundwater table, thereby reducing the potential risk of future groundwater contamination.

During the quarry backfilling and restoration works, the presence of exposed, unvegetated soil surfaces could give rise to dust blows during dry windy weather. These issues are discussed in more detail in Chapter 7 of the EIS (Air Quality).

### 5.3.3 Do-nothing Scenario

If the application site is not restored completely to former ground level as proposed, and it remains essentially unchanged from its existing layout, the limited, or non-existent soil cover at the site will mean that there is limited, or no protection for groundwater quality. Left unmanaged over time, there is also a small risk that slope or face instability could arise around the existing quarry, most likely in the form of localised soil slope instability or rock fall.

## 5.4 MITIGATION MEASURES

In the long-term, following completion of site restoration works at the application site, it is proposed to leave a section of the upper quarry face exposed along the eastern side (refer to Section 2 and Figure 5.3). Leaving the upper quarry face exposed in this way would mean it remains available for inspection by interested parties (by arrangement) for the purpose of geological education and/or interpretation as required and is deemed to reduce the magnitude of the impact to low. With the implementation of this mitigation measure at the quarry, the residual significance of this impact for the County Geological Site is therefore assessed as minor.

In order to minimise the risk of importing and introducing contaminated soil to the site, management systems will be introduced at the application site to establish the source of imported materials in advance and to confirm that they are inert. Multiple level soil testing regimes will be established at the site and will include

- (i) Basic characterisation testing covering a wide range of parameters to determine the leaching behaviour of soils imported to site
- (ii) Frequent, compliance testing covering a limited range of key soil parameters and
- (iii) Comprehensive on-site verification, comprising visual inspection and record of all imported soil unloading at the site

During backfilling of the quarry, all temporary surfaces should be graded to facilitate over ground run-off of surface water, thereby minimising the volume of rainfall percolating through the backfilled soil. This will further reduce any residual risks of potential contaminants leaching into the groundwater.

In order to confirm that there are no residual risks to soil or groundwater, monitoring of groundwater should continue for the duration of the quarry backfilling works and for a short aftercare period.

In order to reduce the risk of localised erosion and potential dust emissions during the backfilling works, bare or exposed subsoils, particularly those outside the quarry void, should be kept to a minimum, insofar as practicable. Consideration could be given to establishing temporary vegetation cover over exposed soil surfaces pending final backfilling and restoration to original ground level.

In order to maximise the future agricultural potential of the restored land, a minimum 150mm thick layer of topsoil and 300mm thick layer of subsoil should be placed over the backfilled materials. The final landform should also be graded so as to facilitate over ground run-off of surface water.

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## REFERENCES

**An Foras Taluntais (1980)** 'Soil Associations of Ireland and Their Land use Potential National Soil Survey of Ireland,

**Fingal County Development Plan (2011 – 2017)**

**Geological Survey of Ireland (2004)** 'Geology of Meath – Sheet 13'

**Geological Survey of Ireland Landslides Working Group (2006)** 'Landslides in Ireland'

**Aaron Clarke, Matthew Parkes and Sarah Gately (December 2007)** 'The Geological Heritage of Fingal - An audit of County Geological Sites in Fingal' Geological Survey of Ireland Irish Geological Heritage Programme

**Office of Public Works - [www.floodmaps.ie](http://www.floodmaps.ie)**

**Teagasc (2004)** 'Subsoil Map of Ireland'

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**FIGURES**

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**APPENDIX 5.1**  
**Ground Investigation Report (January 2009)**

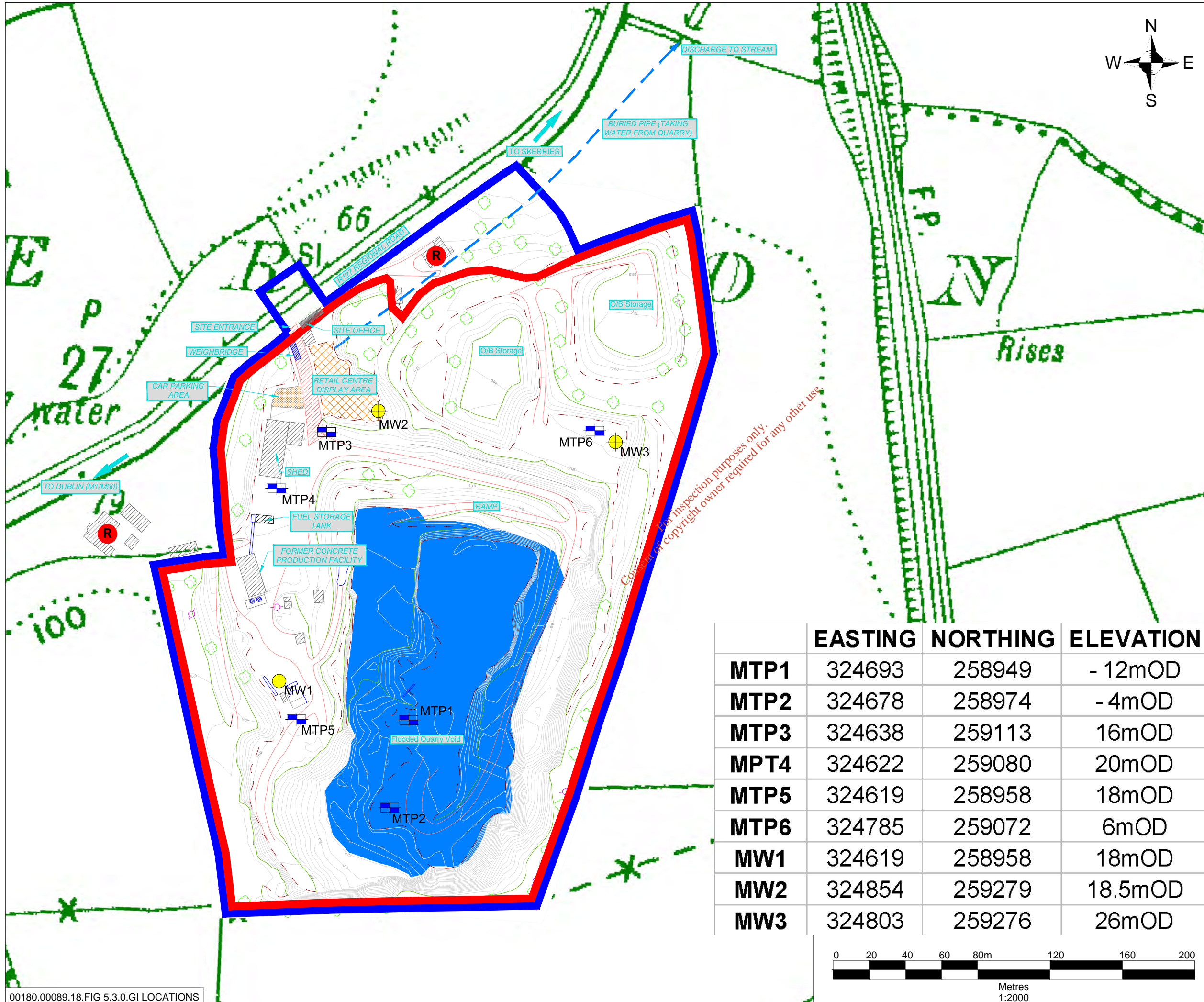
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**APPENDIX 5.2**

**Milverton Quarry IGH Theme 8 Lower Carboniferous**

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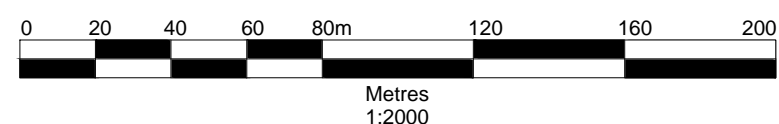
**NOTES**

1. Based on OSi 25inch Dublin Sheet No. 5 & 5a
2. Ordnance Survey of Ireland Licence No. SU 0000714 (c) Ordnance Survey of Ireland & Government of Ireland

**LEGEND**

- Applicant's Land Interest (c. 8.6ha)
- Waste Licence Application Area (c. 7.9ha)
- Monitoring Well Locations (MW5)
- Trial Pit Locations (TP1)

	EASTING	NORTHING	ELEVATION
<b>MTP1</b>	324693	258949	- 12mOD
<b>MTP2</b>	324678	258974	- 4mOD
<b>MTP3</b>	324638	259113	16mOD
<b>MPT4</b>	324622	259080	20mOD
<b>MTP5</b>	324619	258958	18mOD
<b>MTP6</b>	324785	259072	6mOD
<b>MW1</b>	324619	258958	18mOD
<b>MW2</b>	324854	259279	18.5mOD
<b>MW3</b>	324803	259276	26mOD





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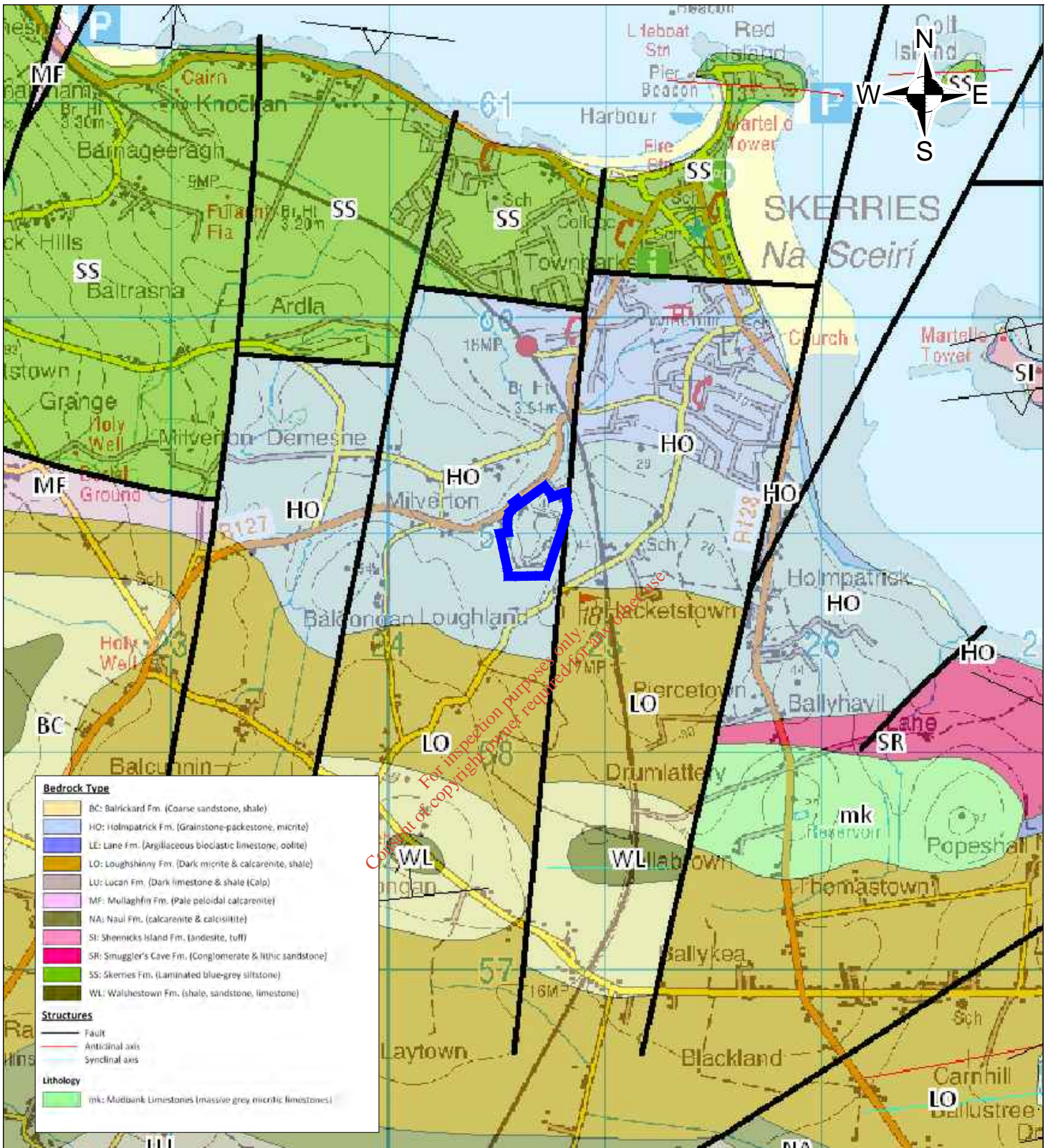
**ROADSTONE LTD.**  
WASTE LICENCE APPLICATION  
WASTE RECOVERY FACILITY,  
MILVERTON, SKERRIES, CO. DUBLIN

**GROUND INVESTIGATION LOCATIONS**

**FIGURE 5.3**

Scale 1:2,000 @ A3      Date JUNE 2014





**LEGEND**

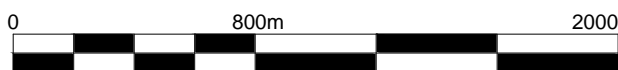
Applicant's Land Interest (c.0.86 ha)



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**NOTES**

1. Extract from Ordnance Survey Discovery Map No. 43
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Metres  
1:25,000

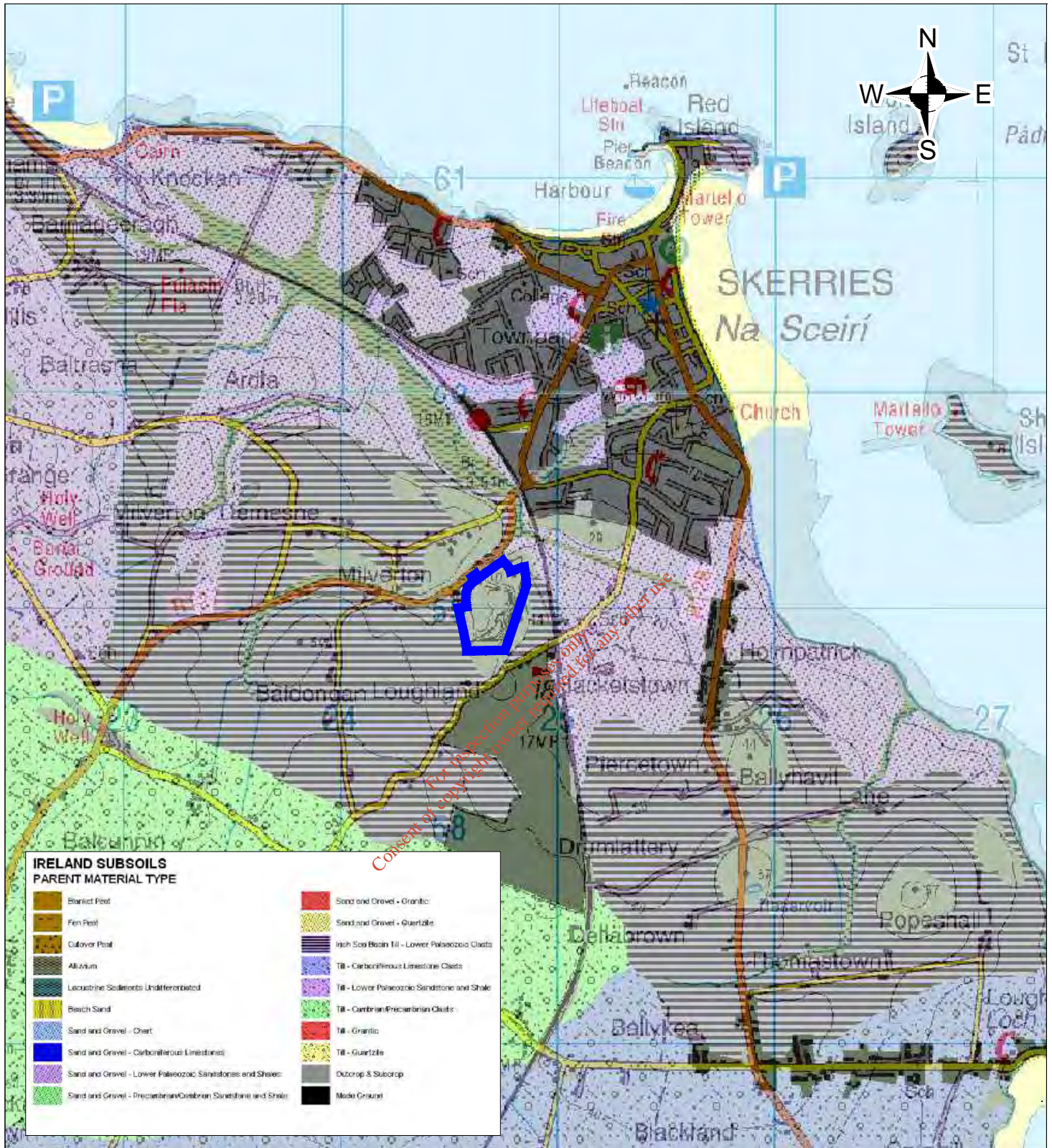
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MILVERTON, SKERRIES, CO. DUBLIN

**BEDROCK MAP**

**FIGURE 5.2**

Scale  
1:25,000 @ A4

Date  
JUNE 2014

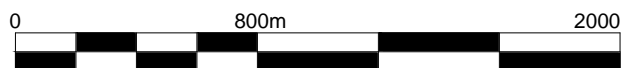


**LEGEND**

Applicant's Land Interest (c.8.6 ha)

**NOTES**

1. Extract from Ordnance Survey Discovery Map No. 43
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Metres  
1:25,000

00180.00089.18.FIG 5.1.0.SUBSOILS MAP



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SUBSOILS MAP

**FIGURE 5.1**

Scale  
1:25,000 @ A4

Date  
JUNE 2014

## FINGAL - COUNTY GEOLOGICAL SITE REPORT

<b>NAME OF SITE</b>	<b>Milverton Quarry</b>
Other names used for site	
<b>IGH THEME:</b>	IGH 8 (Lower Carboniferous)
<b>TOWNLAND(S)</b>	Milverton
<b>NEAREST TOWN</b>	Skerries
<b>SIX INCH MAP NUMBER</b>	5
<b>NATIONAL GRID REFERENCE</b>	324671 259032 = O 246 590
<b>1:50,000 O.S. SHEET NUMBER</b>	43 <b>1/2 inch Sheet No.</b> 13

### Outline Site Description

Working quarry.

### Geological System/Age and Primary Rock Type

Lower Carboniferous (Viséan) limestone and shale of the Holmpatrick Formation.

### Main Geological or Geomorphological Interest

This small Roadstone quarry just south of Skerries shows good exposures of predominantly thick bedded to massive Viséan shelf limestone with occasional shale beds. These rocks display sub vertical joints that should not be confused with the bedding, which dips shallowly to the north east. Karst weathering features known as pipes and caves were observed. These features are mostly clay infilled (orange-brown gravelly clay), with some up to 8m high, and are found within the massive limestone in the upper levels of this quarry. The limestone was used in the building of the Rockabill Lighthouse.

### Site Importance

This is a good example of exposed Lower Carboniferous rocks of the Holmpatrick Formation, which otherwise can only be partially viewed along the Fingal coastline, just south of Skerries. The presence of karst weathering features along some of the quarry walls may make this site a good teaching locality and it is therefore recommended as a County Geological Site.

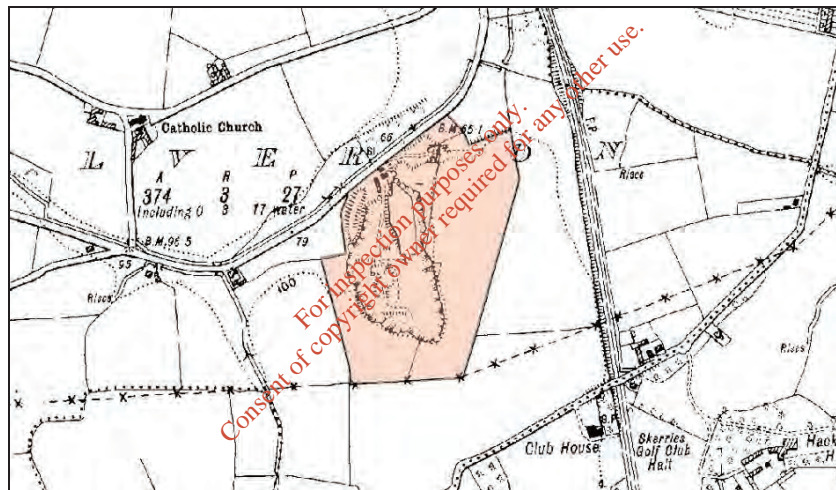
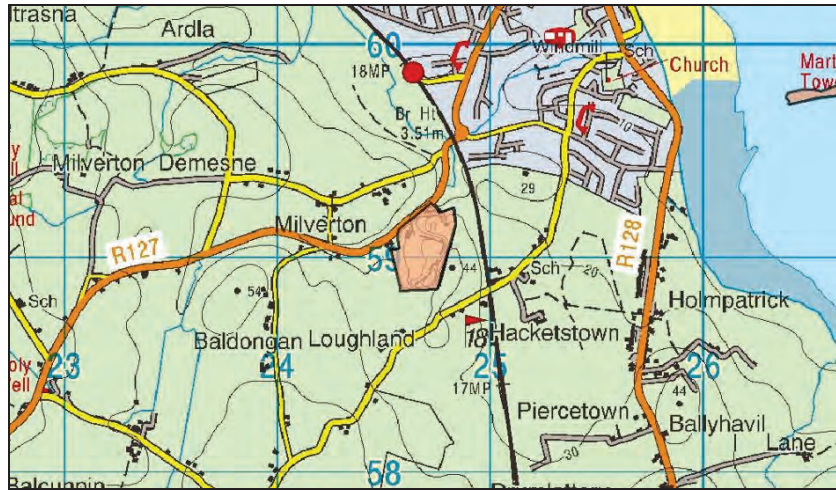
### Management/promotion issues

Although this is a small, relatively quiet working quarry it is still a potentially hazardous environment and would not be suitable for general promotion without appropriate access arrangements being made with Roadstone. There are potential opportunities here to create safe viewing places associated with the retail display area for quarry products.



Left: This vertical feature, called a pipe, is the product of karst weathering. The pipe seen here is partially infilled with orange-brown clay. These features can only be seen along this particular section of the quarry.  
Right: A view from the south west corner of Milverton Quarry.

# Milverton Quarry



## Roadstone Dublin Ltd.

### Inert Waste Recovery Facilities Milverton Quarry, Co. Dublin.

# Factual Report on Trial Pit Excavations and Soil Chemical Testing

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## January 2009



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Tallaght,  
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- 1 INTRODUCTION
  - 1.1 Purpose of Site Investigations
  - 1.2 Site Description
- 2 REGIONAL GEOLOGY
  - 2.1 Quaternary Subsoil Geology
  - 2.2 Solid Geology
- 3 GROUND INVESTIGATION - TRIAL PIT SURVEYS
- 4 LABORATORY TEST DATA

### FIGURES

- Figure 1. Milverton Site Location Map (1:50,000)
- Figure 2. Milverton Trial Pit Locations (1:2,500)

### APPENDICES

- Appendix A Milverton Trial Pit Logs and Photographs
- Appendix B Results of Soil Chemical Analysis

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## 1 INTRODUCTION

This factual report was prepared for Roadstone Dublin Ltd. by SLR Consulting Ireland (formerly John Barnett and Associates Ltd.) and presents the findings of trial pit excavations undertaken by our staff across part of Roadstone Dublin's existing landholding at Milverton.

### 1.1 Purpose of Site Investigations

The purpose of site investigation was to determine the shallow geology at the site for the preparation of a waste licence for the recovery of inert soil material at the site. The trial pits allowed the existing shallow subsoil geology to be identified and described. Soil samples were also taken for chemical analysis in order to characterise the existing soils at the site. Two soil samples were forwarded to an independent laboratory for chemical analysis.

### 1.2 Site Description

The site at Milverton is located within the existing Roadstone Dublin's existing landholding, located approximately 1.5km west of Skerries town on the R127 Regional Road between Lusk and Skerries, see Figure 1. The site is a worked-out quarry, see Figure 2. Until recently, there was also a concrete production facility and retail paving centre at the site. These activities were suspended at the site in late summer 2008.

The subsoil material has have been removed to facilitate quarrying at the site and are stockpiled around the site perimeter and in the northern area of the site. Some of the glacial till was reused beneath the yard and readymix plant area on the north western side of the site, and some of the material was used to build the access ramp to the quarry floor.

## 2 REGIONAL GEOLOGY

### 2.1 Quaternary Subsoil Geology

The Teagasc Subsoil map (2004) for the area indicates that the area immediately to the east of the site on the top of the hill is characterised by outcropping bedrock at the surface, while the areas around the hill are characterise by glacial till material of Irish Sea Basin origin. The quaternary soils east of the site and the rail line comprise *Sand and Gravel of Lower Palaeozoic sandstone and shale* origin. *Alluvium* is identified along Mill Stream located approximately 0.5km north of the site.

The glacial till subsoil material at the application area has largely been removed to facilitate quarrying and makes up the bulk of the soil stockpiles at the site. There are only minor exposures of subsoil material around the top of the quarry, as faces are heavily vegetated.

### 2.2 Solid Geology

The site at Milverton is underlain by bioclastic limestone of the Holmpatrick Formation. Some oolite occurs in the older, lower rocks in this formation. The Holmpatrick Formation forms part of the Milverton Group which is believed to be of Carboniferous (Visean) age (approximately 330 million years old).

The bedrock is exposed in the existing quarry faces at the site.



### 3 GROUND INVESTIGATION - TRIAL PIT SURVEYS

A series of trial pit surveys were undertaken at Milverton on the 3<sup>rd</sup> December 2008. The objective of the trial pit survey was to:

- i. identify the nature of any the soils and subsoils at the site;
- ii. identify, as far as possible, the depth to bedrock;
- iii. obtain subsoil samples for chemical analysis to establish baseline subsoil quality; and
- iv. establish the depth to groundwater (where encountered).

A total of six trial pits were conducted at Milverton, trial pits MTP1, MTP2, MTP3, MTP4, MTP5 and MTP6 as indicated on Figure 2.

Trial pits MTP1 and MTP2 were conducted on the floor of the existing quarry, see Figure 2. The trial pits encountered between 0.4m and 0.9m of Made Ground comprising crushed aggregate material overlying limestone bedrock.

Trial pits MTP3 and MTP4 were conducted around the existing site infrastructure area and indicate made ground comprising crushed rock fines, crushed aggregate and gravelly clay. No bedrock was encountered in these trial pits, but an examination of the exposed faces in the quarry void indicates that the gravelly clay material underlying the site infrastructure area may be up to c. 4-5m in thickness.

Trial pits MTP5 and MTP6 were conducted on the upper benches of the quarry and only encountered limestone bedrock.

Soil samples taken at trial pits MTP4 and MTP5 were forwarded to a test laboratory for soil quality analysis. The sample from trial pit MTP4 was from glacial till subsoil material which had been placed beneath the concrete production plant and yard area. The sample from MTP5 was from subsoil at or close to the upper weathered bedrock. The results of the soil chemical analyses are presented in Section 4 of this report.

Trial pit logs and photographs of trial pit excavations at Milverton are provided in Appendix A.

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#### 4 LABORATORY TEST DATA

Soil chemical test results from two samples taken from trial pits MTP4 and MTP5 are shown in Table 1 below:

Parameter	Unit	Detection Limit	Leaching Limit Value (10l/kg)*	MTP4	MTP5
				B06577/01	B06577/01
				03/12/2008	03/12/2008
Total Dissolved Solids (CEN 10:1 Leachate)	mg/kg	<350	4,000	<350	1020
Natural Moisture Content	%	<0.1		8.5	6.8
Fluoride as F (CEN 10:1 Leachate)	mg/kg	<1	10	3	3
Chloride as Cl (CEN 10:1 Leachate)	mg/kg	<10	800	15	17
Sulphate (CEN 10:1 Leachate)	mg/kg	<30	1000	41	<30
Antimony as Sb (Low CEN 10:1 Leach)	mg/kg	<0.01	0.06	<0.01	<0.01
Arsenic as As (Low CEN 10:1 Leach)	mg/kg	<0.01	0.5	<0.01	<0.01
Barium as Ba (Low CEN 10:1 Leach)	mg/kg	<0.01	20	1.61	1.43
Cadmium as Cd (Low CEN 10:1 Leach)	mg/kg	<0.004	0.04	<0.004	<0.004
Chromium as Cr (Low CEN 10:1 Leach)	mg/kg	<0.01	0.5	<0.01	0.01
Copper as Cu (Low CEN 10:1 Leach)	mg/kg	<0.01	2	0.06	0.1
Lead as Pb (Low CEN 10:1 Leach)	mg/kg	<0.01	0.5	<0.01	<0.01
Molybdenum Mo (Low CEN 10:1 Leach)	mg/kg	<0.01	0.5	0.09	0.63
Mercury as Hg (Low CEN 10:1 Leach)	mg/kg	<0.0005	0.01	<0.0005	<0.0005
Nickel as Ni (Low CEN 10:1 Leach)	mg/kg	<0.01	0.4	<0.01	<0.01
Selenium as Se (Low CEN 10:1 Leach)	mg/kg	<0.01	0.1	<0.01	<0.01
Zinc as Zn (Low CEN 10:1 Leach)	mg/kg	<0.01	4	0.15	0.12
Coronene	mg/kg	<0.001		<0.001	<0.001
PCB Total of 7 Congeners	mg/kg	<0.001	1	<0.001	<0.001
Total Phenols in CEN 10:1 Leach	mg/kg	<0.1		<0.1	<0.1
Mineral Oil by GC	mg/kg	<1	500	<1	<1
Petrol Range Organics C5-C9	mg/kg	<0.01		<0.01	<0.01
Petrol Range Organics C10+	mg/kg	<0.01		<0.01	<0.01
Benzene	mg/kg	<0.01	6	<0.01	<0.01
Toluene	mg/kg	<0.01	6	<0.01	<0.01
Ethylbenzene	mg/kg	<0.01	6	<0.01	<0.01
Total Xylene	mg/kg	<0.01	6	<0.01	<0.01
Total 17 EPA PAHs	mg/kg	<0.001	2	<0.001	<0.001
Total 6 EPA PAHs	mg/kg	<1.6		<1.6	<1.6
Dissolved Organic Carbon (CEN 10:1 Leachate)	mg/kg	<20	500	26	27
Total Organic Carbon	%	<0.2%	30000	0.2	<0.2

\* Section 2.1.2.1 'Establishing criteria and procedures for the acceptance of waste at Landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC'.

**Table 1 Milverton Trial Pit Soil Chemical Test Results.**

The soil chemical test results from trial pits MTP4 and MTP5 indicate that contaminant levels in the laboratory derived soil leachate are generally below limits set for waste acceptance at inert landfill facilities set by EU Council Decision 2003/33/EC dated 19<sup>th</sup> December 2002, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to the Directive 1999/31/EC'.

Molybdenum levels in the sample from trial pit MTP5 are 0.63 mg/kg while the limit for the acceptance of waste at landfills under the EU Directive discussed above is 0.5 mg/kg. Molybdenum is used in industry in high strength steel alloys and is also used in high pressure and temperature resistant greases; both these sources could be responsible for the presence of molybdenum detected in the sample.

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## FIGURES

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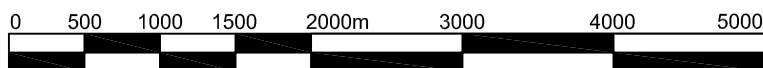


**LEGEND**

— Applicant's Land Interest (c.8.6 ha)

**NOTES**

1. Extract from Ordnance Survey Discovery Map No. 43
2. Ordnance Survey Ireland Licence No. SU 0000709 (c)  
Ordnance Survey Ireland / Government of Ireland



Metres  
1:50,000

0059.00015.18.FIG 1.0.SITE LOC PLAN

SLR CONSULTING IRELAND  
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DUBLIN 14  
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www.slrconsulting.com

---

**ROADSTONE DUBLIN LTD.  
WASTE LICENCE APPLICATION**

---

**WASTE RECOVERY FACILITY,  
MILVERTON, SKERRIES, CO. DUBLIN**

---

**SITE LOCATION PLAN**

---

**FIGURE 1**

Scale 1:50,000 @ A4	Date AUGUST 2009
------------------------	---------------------

NOTES

- Based on OSI 25inch Dublin Sheet No. 5 & 5a
- Ordnance Survey of Ireland Licence No. SU 0000709 (c) Ordnance Survey of Ireland & Government of Ireland

LEGEND

- Applicant's Land Interest (c. 8.6ha)
- Waste Licence Application Area (c. 7.9ha)
- Monitoring Well Locations
- Trial Pit Locations

**roadstone**

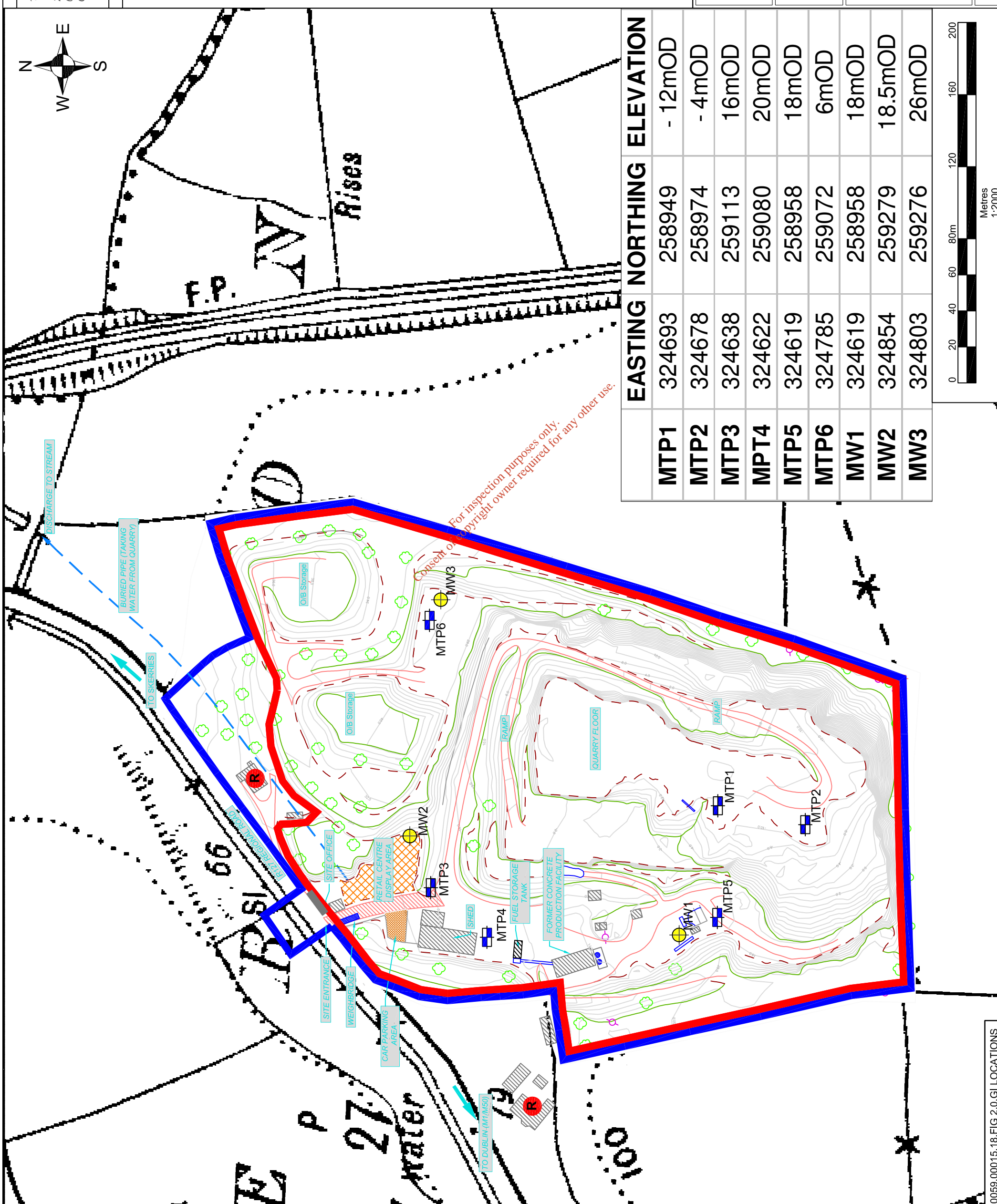
ROADSTONE DUBLIN LTD.  
FORTUNE TOWN  
TALLAGHT  
DUBLIN 24

**SLR**

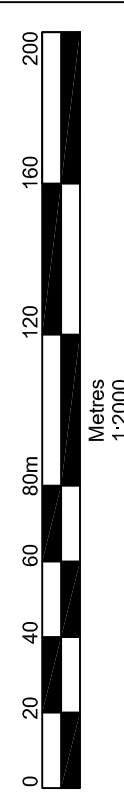
SLR CONSULTING IRELAND  
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ROADSTONE DUBLIN LTD.  
WASTE LICENCE APPLICATION  
WASTE RECOVERY FACILITY,  
MILVERTON, SKERRIES, CO. DUBLIN

**GROUND INVESTIGATION LOCATIONS**



	EASTING	NORTHING	ELEVATION
<b>MTP1</b>	324693	258949	- 12mOD
<b>MTP2</b>	324678	258974	- 4mOD
<b>MTP3</b>	324638	259113	16mOD
<b>MPT4</b>	324622	259080	20mOD
<b>MTP5</b>	324619	258958	18mOD
<b>MTP6</b>	324785	259072	6mOD
<b>MW1</b>	324619	258958	18mOD
<b>MW2</b>	324854	259279	18.5mOD
<b>MW3</b>	324803	259276	26mOD



0059.00015.18.FIG 2.0.GI LOCATIONS

**FIGURE 2**

Scale 1:2,000 @ A3  
Date AUGUST 2009

## APPENDICES

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**APPENDIX A**  
**MILVERTON TRIAL PIT LOGS AND PHOTOGRAPHS**

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Co-ords: 324677E - 258925N  
Level: -

Date  
14/11/2008

Project Name: RDL Fassaroe/Belgard/Milverton

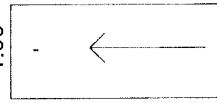
Dimensions: 1.00

Scale  
1:25

Location:

Depth  
0.50m

1.00



Logged By

Client: Roadstone Dublin Ltd.

SLR Project No. 501-059-021

Samples & In Situ Testing				Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Waterstrike	Results				
				0.40			Grey crushed aggregate compacted by site traffic. Rock breaker required to advance through top 300mm. (MADE GROUND)
				0.50			LIMESTONE (BEDROCK)
							Trialpit Complete at 0.50 m
1				1			
2				2			
3				3			
4				4			

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Remarks:

Groundwater:  
None

Stability:  
Pit slides stable

Shoring:  
None

**MTP2**

Project Name: RDL Fassaroe/Belgard/Milverton

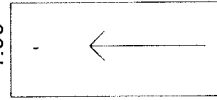
Dimensions: 1.00

Scale  
1:25

Location:

Depth  
2.50m

1.00



Logged By  
PG

Client: Roadstone Dublin Ltd.

SLR Project No. 501-059-021

Samples & In Situ Testing				Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Waterstrike	Results				
				0.70			Crushed aggregate fill (MADE GROUND)
				2.40			Crushed Rock Fines (CRF) (MADE GROUND)
				2.50			Brown gravelly CLAY (placed material on ramp to quarry floor). (MADE GROUND)
Trialpit Complete at 2.50 m							

Consent of copy for inspection purposes only. Consent of copy for owner required for any other use.

Remarks:

Groundwater:  
None

Stability:  
Pit sides stable

Shoring:  
None

**MTP3**



# SLR Consulting Ireland

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Trialpit No  
**MTP4**  
 Sheet 1 of 1

Co-ords: 324616E - 259081N  
 Level: -

Date  
 14/11/2008

Project Name: RDL Fassaroe/Belgard/Milverton

Dimensions: 1.00

Scale  
 1:25

Location:

Depth  
 2.20m

1.00



Logged By

Client: Roadstone Dublin Ltd.

SLR Project No. 501-059-021

Samples & In Situ Testing				Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Waterstrike	Results				
				0.70			Crushed Rock Fines (CRF) (MADE GROUND)
1				1.20			Crushed Aggregate fill material (MADE GROUND)
2				2.20			Brown gravelly CLAY (MADE GROUND)
							Trialpit Complete at 2.20 m
3							
4							

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Remarks:

Groundwater:  
 None

Stability:  
 Pit sides stable

Shoring:  
 None

**MTP4**



# SLR Consulting Ireland

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Trialpit No  
**MTP5**  
 Sheet 1 of 1

Co-ords: 324626E - 258953N  
 Level: -

Date  
 14/11/2008

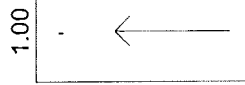
Project Name: RDL Fassaroe/Belgard/Milverton

Dimensions: 1.00

Scale  
 1:25

Location:

Depth  
 0.30m



Logged By

Client: Roadstone Dublin Ltd.

SLR Project No. 501-059-021

Samples & In Situ Testing				Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Waterstrike	Results				
				0.20			Weathered LIMESTONE with brown clayey infill material (WEATHERED LIMESTONE)
				0.30			LIMESTONE (BEDROCK)
Trialpit Complete at 0.30 m							
1				1			
2				2			
3				3			
4				4			

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Remarks:

Groundwater:  
 None

Stability:  
 Pit sides stable

Shoring:  
 None

**MTP5**



# SLR Consulting Ireland

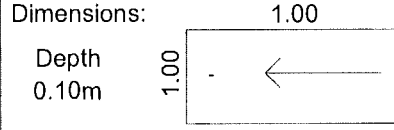
Unit 7, Dundrum Business Pk.,  
 Windy Arbour, Dublin 14, Ireland.  
 Tel: +353 1 2964667 Fax: +353 1 2964676  
 www.slrconsulting.com

Trialpit No  
**MTP6**  
 Sheet 1 of 1

Co-ords: -  
 Level: -

Date  
 14/11/2008

Project Name: RDL Fassaroe/Belgard/Milverton



Scale  
 1:25  
 Logged By  
 PG

Location:

Client: Roadstone Dublin Ltd.

SLR Project No. 501-059-021

Samples & In Situ Testing				Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Waterstrike	Results				
0.10				0.10		LIMESTONE (LIMESTONE BEDROCK)	Trialpit Complete at 0.10 m
1				1			
2				2			
3				3			
4				4			

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Remarks:



Groundwater: None

Stability: Stable

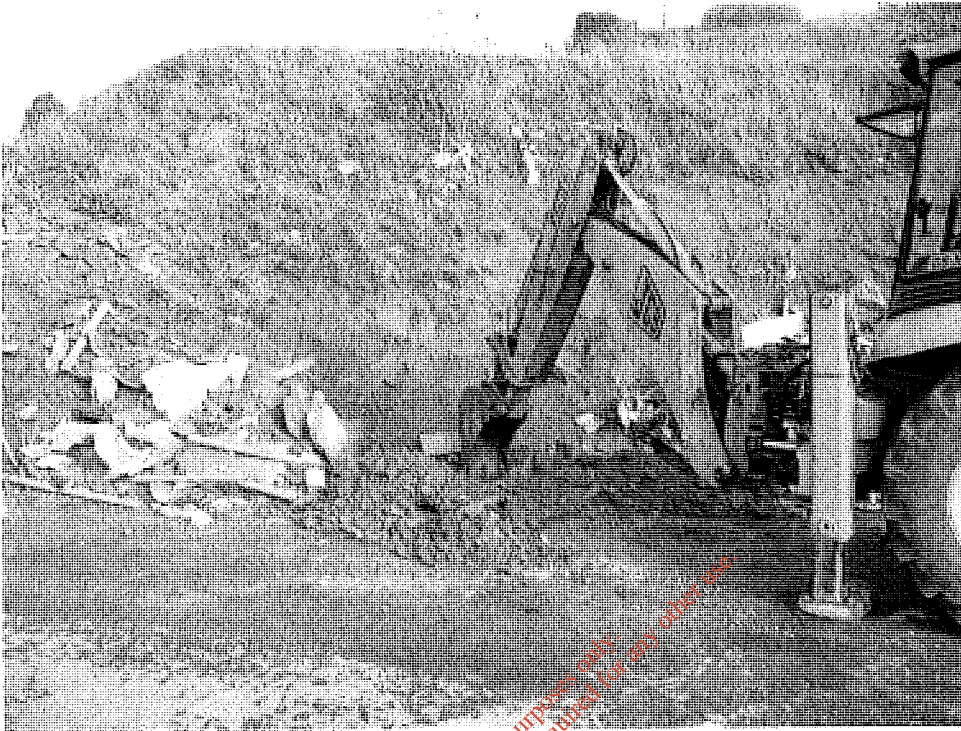

Shoring: None



**MTP6**


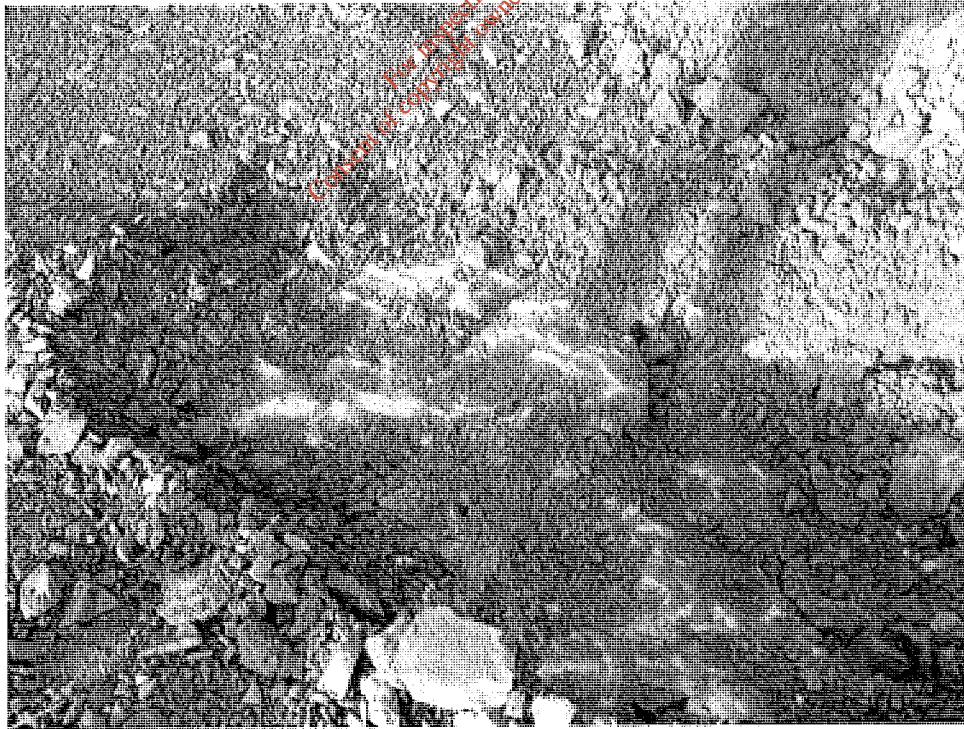
<p><b>Project Name:</b> Milverton Ground Investigation. <b>Location:</b> Milverton <b>Date:</b> December 2008</p>	<p>Trial Pit No. <b>MTP1</b></p>
	
	
<p><b>Remarks:</b> Refer to Figure 2 for Trial Pit Locations.</p>	<p><b>MTP1</b></p>


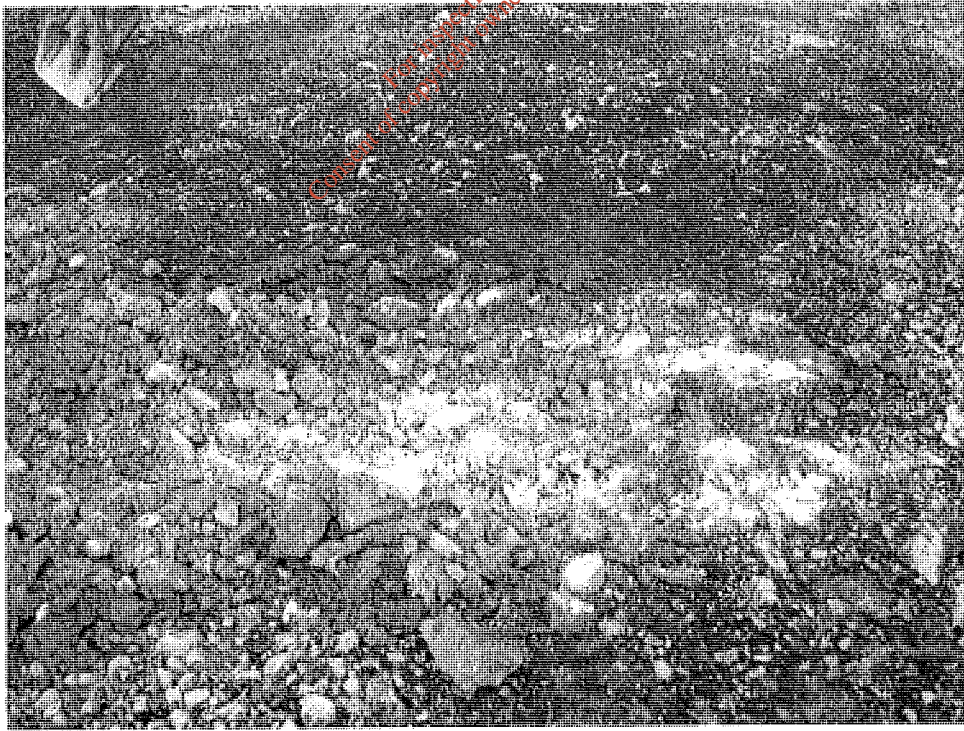
<p><b>Project Name:</b> Milverton Ground Investigation. <b>Location:</b> Milverton <b>Date:</b> December 2008</p>	<p><b>Trial Pit No.</b> <b>MTP2</b></p>
	
	
<p><b>Remarks:</b> Refer to Figure 2 for Trial Pit Locations.</p>	<p><b>MTP2</b></p>



<p><b>Project Name:</b> Milverton Ground Investigation. <b>Location:</b> Milverton <b>Date:</b> December 2008</p>	<p>Trial Pit No. <b>MTP3</b></p>
	
	
<p><b>Remarks:</b> Refer to Figure 2 for Trial Pit Location</p>	<p><b>MTP3</b></p>

<p><b>Project Name:</b> Milverton Ground Investigation. <b>Location:</b> Milverton <b>Date:</b> December 2008</p>	<p>Trial Pit No. <b>MTP4</b></p>
	
	
<p><b>Remarks:</b> Refer to Figure 2 for Trial Pit Locations</p>	<p><b>MTP4</b></p>

<p><b>Project Name:</b> Milverton Ground Investigation. <b>Location:</b> Milverton <b>Date:</b> December 2008</p>	<p>Trial Pit No. <b>MTP5</b></p>
	
	
<p><b>Remarks:</b> Refer to Figure 2 for Trial Pit Locations</p>	<p><b>MTP5</b></p>

<p><b>Project Name:</b> Milverton Ground Investigation. <b>Location:</b> Milverton <b>Date:</b> December 2008</p>	<p>Trial Pit No. <b>MTP6</b></p>
	
	
<p><b>Remarks:</b> Refer to Figure 2 for Trial Pit Locations</p>	<p><b>MTP6</b></p>

**APPENDIX B**  
**ALCONTROL SOIL CHEMICAL TEST RESULTS**  
**MILVERTON - ALCONTROL B06577/01**

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**CERTIFICATE OF ANALYSIS**

**Client:** SLR (Dublin) JBA  
CSA House  
Unit 7  
Dundrum Business Park  
Windy Harbour  
Dublin14  
Ireland

**Attention:** Peter Glanville

**Date:** 19 December, 2008

**Our Reference:** 08-B06577/02

**Your Reference:** Milverton ELS

**Location:**

A total of 3 samples was received for analysis on Wednesday, 3 December 2008. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

*Dylan Halpin*

*Lorraine McNamara*

**Dylan Halpin**  
Team Leader Project Co-ordination

**Lorraine McNamara**  
General Manager

**Compiled By**

*Mark Butler*



Printed at 13:18 on 23/12/2008











# ALcontrol Laboratories Ireland

## Test Schedule Summary

Ref Number: **08-B06577/02**  
 Client: SLR (Dublin) JBA  
 Date of Receipt: 03/12/2008

Sample Type: **SOIL**  
 Location:  
 Client Contact: Peter Glanville  
 Client Ref: Millverton ELS

\* SUBCONTRACTED TO OTHER LABORATORY / \*\* SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	CEN 10:1 Leach	CEN 10:1 Leachate Test	2
X	CV AA	Dissolved Mercury Low Level in CEN 10:1 Leachate	2
X	ELTRA	Total Organic Carbon	2
X	GC	PRO & BTEX	2
X	GC FID/CALC	Mineral Oil by GC	2
X	GCMS	Coronene	4
X	GCMS	PAH EPA (16)	4
X	GCMS	PAH Total (17) GCMS (Solid)	4
X	GCMS	PAH Total (6) GCMS <1.6mg/kg (Solid)	2
X	GCMS	PCB 7 Congeners	2
X	GRAVIMETRIC	Natural Moisture Content	2
X	GRAVIMETRIC	Total Dissolved Solids Gravimetric CEN 10:1	2
X	HPLC	Total Phenols by HPLC in CEN 10:1 Leachate	2
X	ICP MS	Dissolved Antimony Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Arsenic Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Barium Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Cadmium Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Chromium Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Copper Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Lead Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Molybdenum Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Nickel Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Selenium Low CEN 10:1 Leach	2
X	ICP MS	Dissolved Zinc Low CEN 10:1 Leach	2
X	IR	Dissolved Organic Carbon in CEN 10:1 Leachate	2
X	KONE	Chloride in CEN 10:1 Leachate	2
X	KONE	Fluoride in CEN 10:1 Leachate	2
X	KONE	Sulphate in CEN 10:1 Leachate	2









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**APPENDIX**



## APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N<sub>2</sub> by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, TPH by IR, OFGs and SEM.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.
8. NDP – No Determination Possible due to insufficient/unsuitable sample.
9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.
10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

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