SECTION 5: SOILS AND 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 Dublin 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:

Peter Glanville, 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
- Quarternary Section, Geological Survey of Ireland, Haddington Road, Dublin 4
- Bedrock Geology Section, Geological Survey of Ireland, Haddington Road, Dublin 4
- Groundwater Section, Geological Survey of Ireland, Haddington Road, Dublin 4

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 Dublin 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.

Soil 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 soils deposited or formed during the last 2 million years. Such soils are termed quaternary soils. The two main types of quaternary soil 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, has 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 at 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 (Visean) 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, and there is relatively little groundwater in the quarry void. There are a number of small groundwater seepeges on the quarry faces, and there is a sump on the quarry floor which is pumped out.

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 the 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 / workyard area, and the other from trial pit FTP5, located immediately to the west of the shed / workyard 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 quarternary 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);
- 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 indicates 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 workyard 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.

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) 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 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 recently been stripped, a face into the till material is exposed, however there is little evidence to date of any weathering or soil erosion at the exposed face.

5.2.9 Geological Heritage

The Geological Survey of Ireland has confirmed that there are no established or proposed geological National Heritage (pNHA) sites in the immediate vicinity of the application site.

The nearest site of geological interest is approximately 2km to the east-southeast (ESE), at the proposed Natural Heritage Area (pNHA) along the coast between Loughshinny and Rush. The GSI advises that this entire section of coastline is recommended for designation 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.

The rock exposures within the existing quarry are not considered of sufficient interest to warrant designation or protected status.

No County Geological Sites or sites of geological interest or importance are identified by the Fingal County Development Plan (2005 - 2011).

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, Roadstone Dublin Ltd. acquired the site and intensified quarrying activity and established a readymix facility at the site. Roadstone Dublin Ltd. also established a retail paving centre at the site. Quarrying, concrete production and retail centre operations have all been suspended at the site since late summer 2008.

There is no land available to Roadstone Dublin Ltd. at this location to expand the quarry and as a result, rock extraction has been suspended at the site. The demand for aggregates which was met from the site at Milverton will be met in future by other Roadstone Dublin facilities in the Greater Dublin Area including Feltrim and Huntstown.

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 overleaf:

Attribute	Status / Occurrence	Importance
Geohazards	Erosion of exposed soils on existing slopes.	Low
Geological Heritage	No heritage feature at or contiguous to site	Low
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:

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	Improvement in appearance of hill – a local landscape feature	Small, positive
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 backfilling and restoration of the application site will return ground levels to their original levels at the site. 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 (2005-2011).

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.

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 rockfall.

5.4 MITIGATION MEASURES

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 overground 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 overground run-off of surface water.

REFERENCES

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

Fingal County Development Plan (2005 – 2011)

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

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

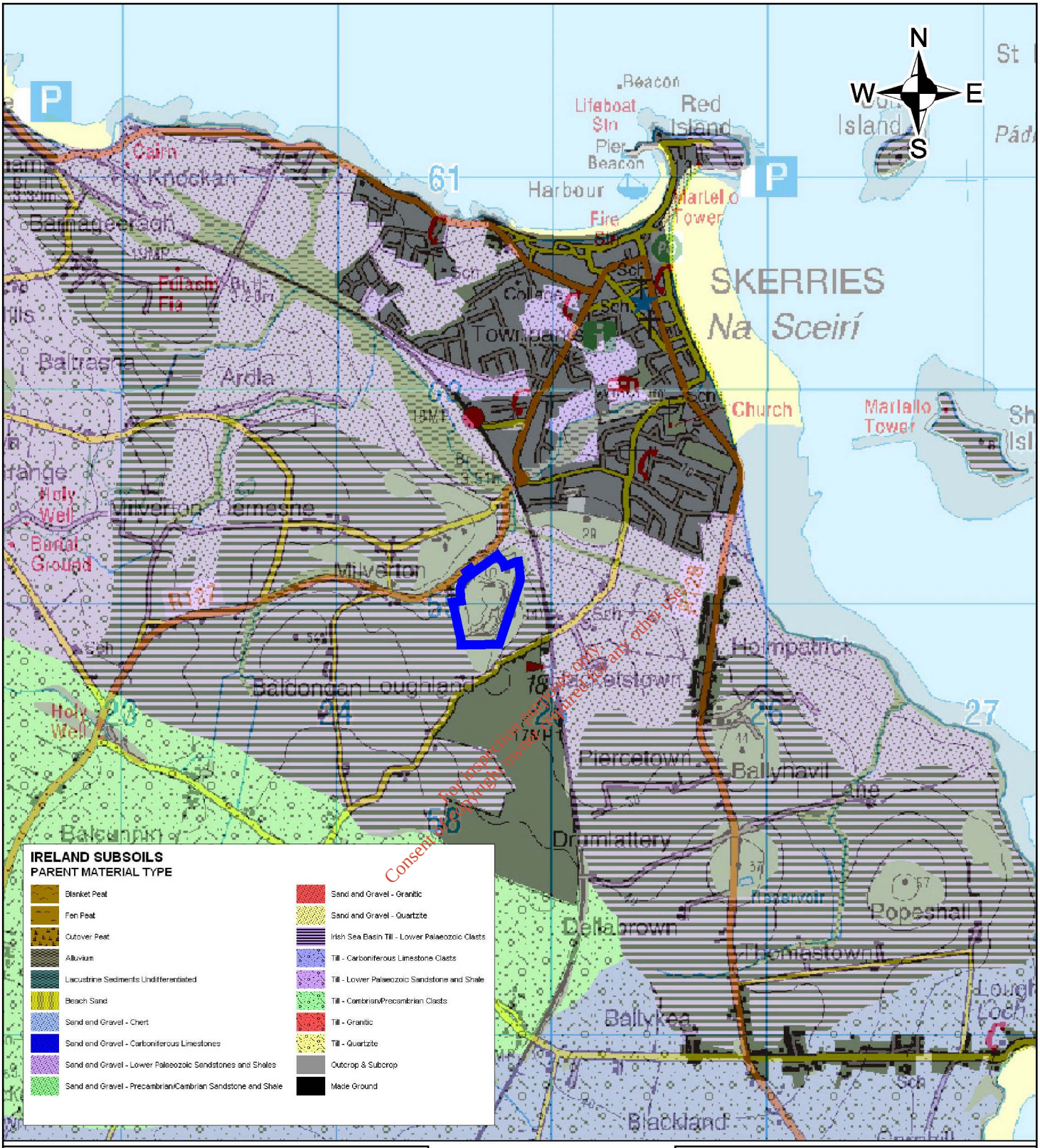
Office of Public Works - www.floodmaps.ie

Teagasc (2004) 'Subsoil Map of Ireland'

FIGURES

APPENDIX 5.1

GROUND INVESTIGATION REPORT
(JANUARY 2009)



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*

0 800m 2000

Metres
1:25,000

0059.00015.18.FIG 5.1.0.SUBSOILS MAP

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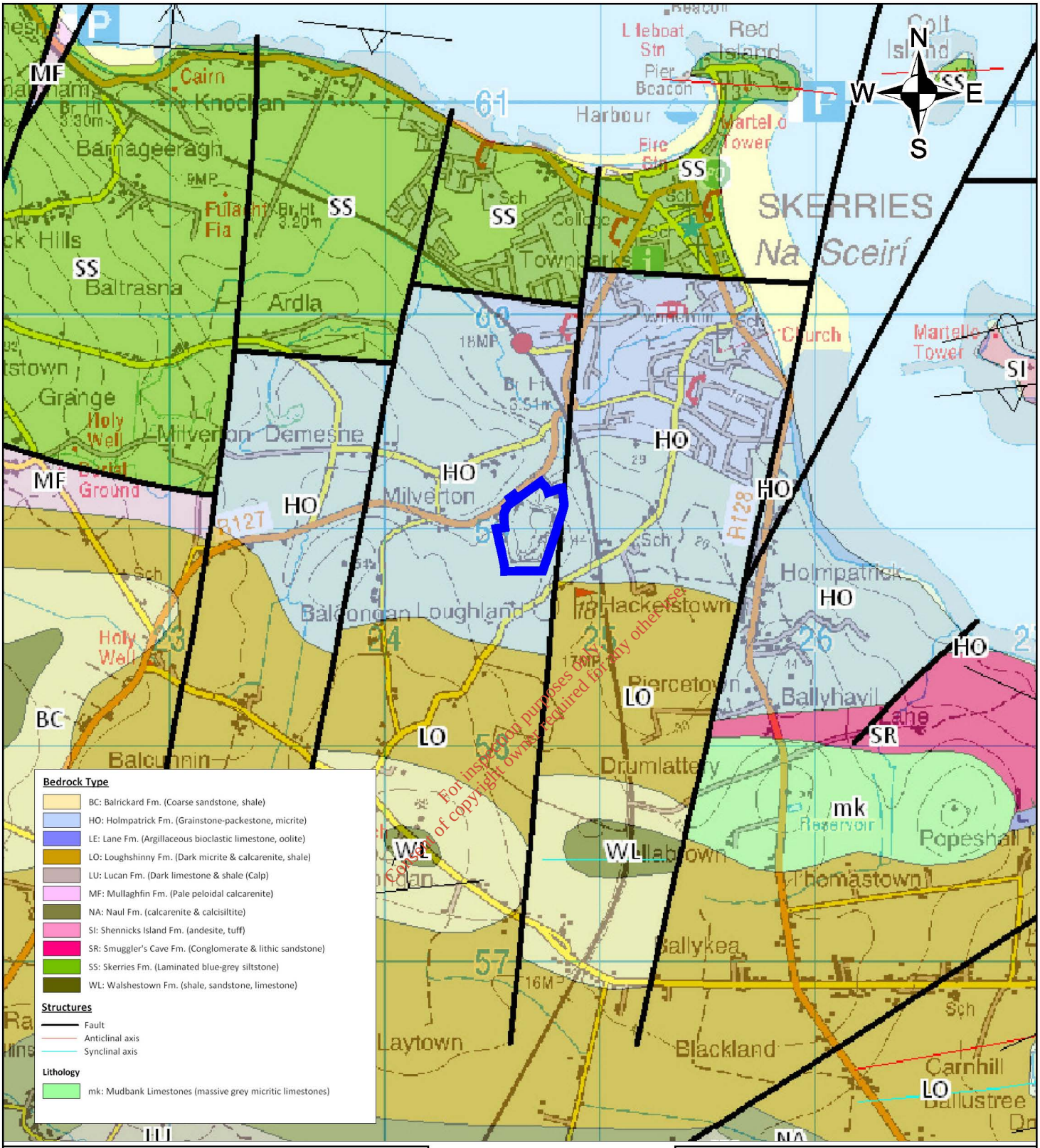
WASTE LICENCE APPLICATION

WASTE RECOVERY FACILITY,
MILVERTON, SKERRIES, CO. DUBLIN

SUBSOILS MAP

FIGURE 5.1

Scale	Date
1:25,000 @ A4	AUGUST 2009



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

0 800m 2000

Metres
1:25,000

0059.00015.18.FIG 5.4.0.BEDROCK MAP

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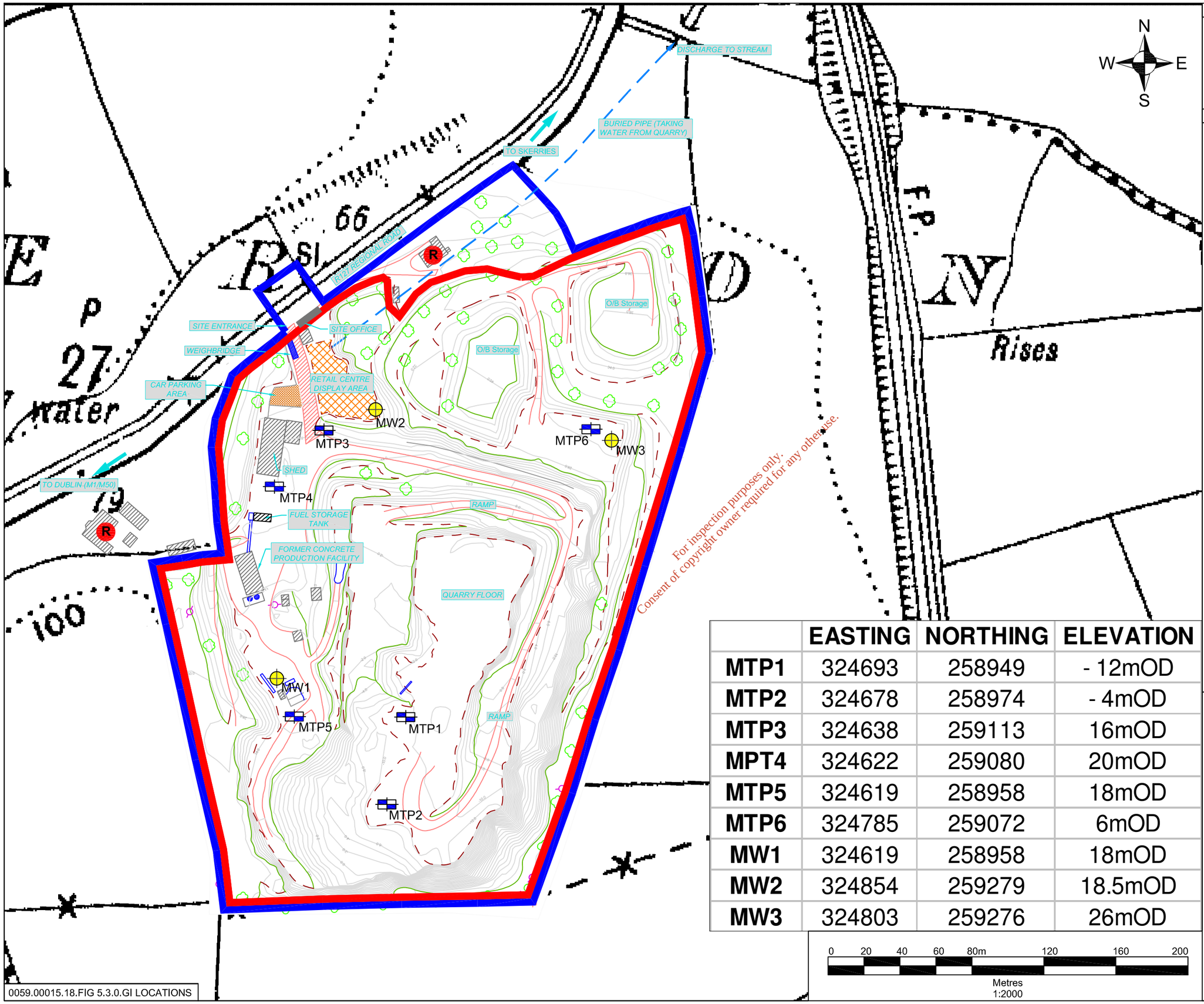
WASTE LICENCE APPLICATION

WASTE RECOVERY FACILITY,
MILVERTON, SKERRIES, CO. DUBLIN

BEDROCK MAP

FIGURE 5.2

Scale	Date
1:25,000 @ A4	AUGUST 2009



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

0 20 40 60 80m 120 160 200

Metres
1:2000

NOTES

1. Based on OSi 25inch Dublin Sheet No. 5 & 5a

2. 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)
- MW5 — Monitoring Well Locations
- TP1 — Trial Pit Locations

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GROUND INVESTIGATION LOCATIONS

FIGURE 5.3

Scale: 1:2,000 @ A3

Date: AUGUST 2009

0059.00015.18.FIG 5.3.0.GI LOCATIONS