

## Roadstone Dublin Ltd.

### Inert Waste Recovery Facility Milverton, Skerries, Co. Dublin

# Factual Report on Groundwater Well Installation and Hydrochemical Testing

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## January 2009



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*Prepared for :*

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## 1 INTRODUCTION

This factual report was prepared for Roadstone Dublin Ltd. by SLR Consulting and presents details of the installation of groundwater monitoring wells at Milverton quarry during December 2008 by Glover Site investigations under the supervision of SLR staff.

### 1.1 Purpose of Site Investigations

The purpose of the well installations was to determine the geology at the site, to allow the monitoring of groundwater level around the periphery of the quarry and to facilitate sampling of groundwater for hydrochemical analysis. These investigations were undertaken in support of an application for a waste licence for the recovery of inert soil waste at the worked-out quarry.

### 1.2 Site Description

The site at Milverton, County Dublin is located approximately 2km to the southwest of Skerries. The site is a limestone quarry that was closed in 2007.

## 2 REGIONAL GEOLOGY

### 2.1 Quaternary Subsoil Geology

The Teagasc Subsoil map (2004) indicates that the site at Milverton 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. Quaternary subsoil east of the application site and the rail line comprises sand and gravel of Lower Palaeozoic sandstone and shale origin. Exposures at the existing quarry indicate that the subsoil material is up to a maximum of 5m deep.

### 2.2 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 forms part of 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.

### 3 INSTALLATION OF GROUNDWATER MONITORING WELLS

Groundwater well drilling started at Milverton on the 11<sup>th</sup> December 2008. The objective of the drilling was

- i. to identify the nature of the geology,
- ii. to obtain rock chippings for visual description,
- iii. to establish the depth to groundwater and
- iv. to facilitate groundwater sampling

A total of three monitoring wells were installed at Milverton, BH01, BH02 and BH03. The well locations are shown in Figure 1. Groundwater well logs are presented in Appendix A.

#### *BH01*

Monitoring well BH01 is located down gradient of the excavation in the western part of the site. The well was drilled at 152mm (6 inches) with self advancing casing (symmetrix). BH01 is located on the upper quarry bench and did not encounter any made ground, soil or subsoil. The borehole was open holed from 3m to a final depth of 21m. A water strike was encountered at 18m below surface.

The piezometer installation comprised of 3m of slotted pipe with 18.5m of riser. The annulus of the borehole was filled with 4m of a gravel filter pack from the base upwards and backfilled to the surface with bentonite. The top 1m of the borehole was completed with concrete and a protective well head installed.

#### *BH02*

Monitoring well BH02 is located up gradient of the excavation in the northern part of the site. Subsoil had been removed from the bedrock surface as part of the quarry operations and as such the drilling commenced immediately into limestone rock. The well was open holed at a diameter of 152mm to a final depth of 30m. A significant water strike was encountered at 19m.

The piezometer installation comprised of 6m slotted pipe with 24.5m of riser. The annulus of the borehole was filled with 7m of a gravel filter pack at the base and backfilled to the surface with bentonite. The top 1m of the borehole was completed with concrete and a protective well head installed.

#### *BH03*

Monitoring well BH03 is located up gradient of the excavation at the north-western side of the site. The well was drilled by symmetrix at a diameter of 152mm. Casing was advanced through made ground (comprising of sandy clay) to 13m where limestone bedrock was encountered. The casing was advanced to 14m and was then open holed to a final depth of 24m. There was a moderate water strike at a depth of 18m.

The piezometer installation comprised of 3m of slotted pipe with 21.5m of riser. The annulus of the borehole was filled with 4m of a gravel filter pack at the base and backfilled to the surface with bentonite. The top 1m of the borehole was completed with concrete and a protective well head installed.

#### 4 GROUNDWATER LEVEL DATA

Groundwater levels were measured during and following completion of each well. The groundwater level may be temporarily raised during the drilling process and piezometer installation and as such, following completion of the wells, the groundwater level was allowed to stabilise. Stabilisation of a well in a bedrock aquifer may be relatively slow and can take a number of weeks to complete. The groundwater levels for each well are presented in the table below.

| Borehole Name | Ground Level mOD | Depth of Hole | Water Strike during drilling | Water level 08/01/09 |
|---------------|------------------|---------------|------------------------------|----------------------|
| BH01          | 15               | 21.00         | c.18                         | 14.30                |
| BH02          | 26               | 30.00         | c.19                         | 10.80                |
| BH03          | 19.5             | 24.00         | c.18                         | 12.20                |

Table 1 Groundwater level data (all measurements in metres below ground level)

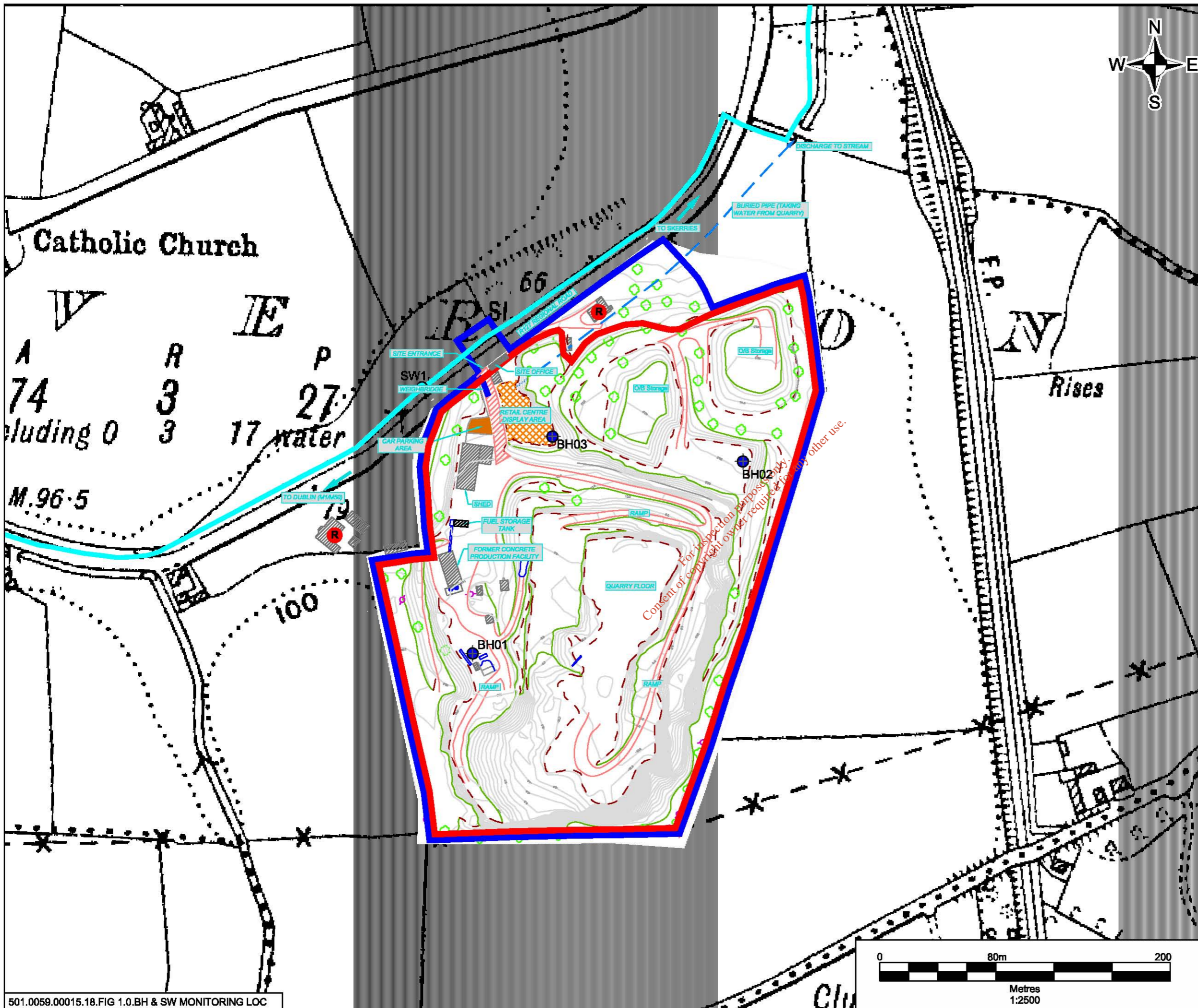
#### 5 LABORATORY HYDROCHEMICAL DATA

Groundwater wells and a surface water sample were sampled on the 8<sup>th</sup> January 2009 by SLR staff. The wells were purged prior to sampling as detailed in the groundwater and surface field sheets presented in Appendix B. The samples were forwarded to ALcontrol Geochem for hydrochemical analysis and the resultant data is presented in Appendix C.

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**FIGURES**

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**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)
  - Groundwater Monitoring Well
  - Surface Water Monitoring Location
  - Buried Pipe
  - Top of Bank
  - Bottom of Bank
  - Road
  - Contour Line
  - Building
  - Internal Unpaved Road
  - Internal Paved Road
  - R Location of Residence

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**WASTE RECOVERY FACILITY,**  
**MILVERTON, SKERRIES, CO.DUBLIN**  
**BH and SW MONITORING LOCATIONS**

**FIGURE 1**

Scale 1:2,500 @ A3      Date AUGUST 2009



**APPENDIX A**

**DRILLING LOGS**

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Site: Fassaroo Quarry, Bray, Co. Wicklow  
Borehole Number: BH01

|   |  |                    |  |                     |
|---|--|--------------------|--|---------------------|
| Boring Method: Symmetrix & Open Hole Drilling | Casing Diameter: 152mm cased to 21.00m | Ground Level (mOD) | Client: Roadstone Dublin Ltd                               | Job Number: 08-0821 |
|   | Location                               | Dates: 01/12/2008  | Engineer: John Barnett & Associates/SLR Consulting Ireland | Sheet: 1/1          |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records              | Level (mOD) | Depth (m) (Thickness) | Description  | Legend | Water |
|-----------|----------------|------------------|-----------------|----------------------------|-------------|-----------------------|--|--------|-------|
|           |                |                  |                 |                            |             |                       | Brown sandy subangular to subrounded fine to coarse GRAVEL and fine SAND (Driller's description) |        |       |
|           |                |                  |                 | Water Strike(1) at 18.00m. |             | (21.00)               |  |        |       |
|           |                |                  |                 | 01/12/2008:                |             | 21.00                 | Complete at 21.00m   |        |       |

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Remarks: Standpipe installed to 21.00m.

Scale (approx): 1:200  
Logged By: PD/HH  
Figure No.: 08-0821.BH01

# Glover Site Investigations Ltd

Site  
Fassaroe Quarry, Bray, Co. Wicklow

Borehole  
Number  
BH01

Installation Type  
Standpipe

Dimensions  
Internal Diameter of Tube [A] = 50 mm  
Diameter of Filter Zone = 152 mm

Client  
Roadstone Dublin Ltd

Job  
Number  
08-0821

Location  
Ground Level (mOD)

Engineer  
John Barnett & Associates/SLR Consulting Ireland

Sheet  
1/1

| Legend                                   | Water | Instr (A) | Level (mOD) | Depth (m) | Description       | Groundwater Strikes During Drilling |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|--|-------|-----------|-------------|-----------|-------------------|-------------------------------------|------|------------------|------------------|-----------------|-------------------|------|----------------|------------------|------------------|-------------------|
|  |       |           |             |           |                   | Date                                | Time | Depth Struck (m) | Casing Depth (m) | Inflow Rate     | Readings          |      |                |                  | Depth Sealed (m) |                   |
|  |       |           |             | 1.00      | Concrete          |                                     |      | 18.00            |                  | Water Strike    |                   |      |                |                  |                  |                   |
| Groundwater Observations During Drilling |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
| Start of Shift                           |       |           |             |           |                   | End of Shift                        |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|  |       |           |             |           |                   | Date                                | Time | Depth Hole (m)   | Casing Depth (m) | Water Depth (m) | Water Level (mOD) | Time | Depth Hole (m) | Casing Depth (m) | Water Depth (m)  | Water Level (mOD) |
|  |       |           |             |           | Bentonite Seal    | 01/12/08                            |      |                  |                  |                 |                   |      | 21.00          |                  |                  |                   |
| Instrument Groundwater Observations      |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
| Inst. [A] Type :                         |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|  |       |           |             |           |                   | Date                                | Time | Depth (m)        | Level (mOD)      | Remarks         |                   |      |                |                  |                  |                   |
|  |       |           |             | 14.00     | Slotted Standpipe |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|  |       |           |             | 20.00     | Gravel Filter     |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|  |       |           |             | 21.00     |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |

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Remarks  
Upright cover fitted.

# Glover Site Investigations Ltd

Site  
Fassaroe Quarry, Bray, Co. Wicklow

Borehole  
Number  
**BH02**

|   |  |                     |  |                       |
|---|--|---------------------|--|-----------------------|
| Boring Method<br>Symmetrix & Open Hole Drilling | Casing Diameter<br>152mm cased to 24.00m | Ground Level (mOD)  | Client<br>Roadstone Dublin Ltd                               | Job Number<br>08-0821 |
|   | Location                                 | Dates<br>03/12/2008 | Engineer<br>John Barnett & Associates/SLR Consulting Ireland | Sheet<br>1/1          |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records              | Level (mOD) | Depth (m) (Thickness) | Description   | Legend | Water |
|-----------|----------------|------------------|-----------------|----------------------------|-------------|-----------------------|---|--------|-------|
|           |                |                  |                 |                            |             |                       | Brown sandy subangular to subrounded fine to coarse GRAVEL and very fine SAND (Driller's description) |        |       |
|           |                |                  |                 | Water Strike(1) at 20.00m. | 20.00       |                       | Brown sandy subangular to subrounded fine to coarse GRAVEL and very fine SAND (Driller's description) |        |       |
|           |                |                  |                 | 03/12/2008:                | 24.00       |                       | Complete at 24.00m  |        |       |

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Remarks  
Standpipe installed to 24.00m.

Scale (approx) 1:200  
Logged By PD/HH  
Figure No. 08-0821.BH02

# Glover Site Investigations Ltd

Site  
Fassaroe Quarry, Bray, Co. Wicklow

Borehole  
Number  
**BH02**

Installation Type  
Standpipe  
Dimensions  
Internal Diameter of Tube (A) = 50 mm  
Diameter of Filter Zone = 152 mm

Client  
Roadstone Dublin Ltd

Job  
Number  
08-0821

Location  
Ground Level (mOD)  
Engineer  
John Barnett & Associates/SLR Consulting Ireland

Sheet  
1/1

| Legend | Water | Instr (A) | Level (mOD) | Depth (m) | Description | Groundwater Strikes During Drilling      |      |                  |                  |                   |                   |      |      |                |                  |                 |                   |
|--------|-------|-----------|-------------|-----------|-------------|--|------|------------------|------------------|-------------------|-------------------|------|------|----------------|------------------|-----------------|-------------------|
|        |       |           |             |           |             | Date                                     | Time | Depth Struck (m) | Casing Depth (m) | Inflow Rate       | Readings          |      |      |                | Depth Sealed (m) |                 |                   |
|        |       |           |             | 1.00      | Concrete    |  |      | 20.00            |                  | Water Strike      |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             | Groundwater Observations During Drilling |      |                  |                  |                   |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             | Start of Shift                           |      |                  |                  |                   | End of Shift      |      |      |                |                  |                 |                   |
|        |       |           |             |           |             | Date                                     | Time | Depth Hole (m)   | Casing Depth (m) | Water Depth (m)   | Water Level (mOD) | Date | Time | Depth Hole (m) | Casing Depth (m) | Water Depth (m) | Water Level (mOD) |
|        |       |           |             |           |             | 03/12/08                                 |      |                  |                  |                   |                   |      |      | 24.00          |                  |                 |                   |
|        |       |           |             |           |             | Instrument Groundwater Observations      |      |                  |                  |                   |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             | Inst. (A) Type :                         |      |                  |                  |                   |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             | Instrument (A)                           |      |                  |                  |                   |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             | Date                                     | Time | Depth (m)        | Level (mOD)      | Remarks           |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             |  |      | 18.00            |                  | Slotted Standpipe |                   |      |      |                |                  |                 |                   |
|        |       |           |             |           |             |  |      | 24.00            |                  |                   |                   |      |      |                |                  |                 |                   |

Remarks  
Upright cover fitted.

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# Glover Site Investigations Ltd

Site  
Fassaroe Quarry, Bray, Co. Wicklow  
Borehole Number  
BH03

Boring Method  
Symmetrix & Open Hole Drilling  
Casing Diameter  
152mm cased to 30.00m  
Ground Level (mOD)  
Client  
Roadstone Dublin Ltd  
Job Number  
08-0821

Location  
Dates  
09/12/2008  
Engineer  
John Barnett & Associates/SLR Consulting Ireland  
Sheet  
1/1

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records              | Level (mOD) | Depth (m) (Thickness) | Description   | Logend | Water |
|-----------|----------------|------------------|-----------------|----------------------------|-------------|-----------------------|---|--------|-------|
|           |                |                  |                 |                            |             |                       | Brown sandy SILT and fine SAND and GRAVEL (Driller's description) |        |       |
|           |                |                  |                 |                            |             | (15.00)               |   |        |       |
|           |                |                  |                 | Water Strike(1) at 15.00m. |             | 15.00<br>(3.00)       | Stiff brown CLAY (Driller's description)                          |        | ▽1    |
|           |                |                  |                 |                            |             | 18.00                 | Brown gravelly CLAY (Driller's description)                       |        |       |
|           |                |                  |                 |                            |             | (12.00)               |   |        |       |
|           |                |                  |                 | 09/12/2008:                |             | 30.00                 | Complete at 30.00m  |        |       |

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Remarks  
Standpipe Installed to 30.00m.

Scale (approx)  
1:200  
Logged By  
PD/HH

Figure No.  
08-0821.BH03

# Glover Site Investigations Ltd

Site  
Fassaroe Quarry, Bray, Co. Wicklow

Borehole  
Number  
BH03

Installation Type  
Standpipe

Dimensions  
Internal Diameter of Tube (A) = 50 mm  
Diameter of Filter Zone = 152 mm

Client  
Roadstone Dublin Ltd

Job  
Number  
08-0821

Location  
Ground Level (mOD)  
Engineer  
John Barnett & Associates/SLR Consulting Ireland

Sheet  
1/1

| Legend                                   | Water | Instr (A) | Level (mOD) | Depth (m) | Description       | Groundwater Strikes During Drilling |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|--|-------|-----------|-------------|-----------|-------------------|-------------------------------------|------|------------------|------------------|-----------------|-------------------|------|----------------|------------------|------------------|-------------------|
|  |       |           |             |           |                   | Date                                | Time | Depth Struck (m) | Casing Depth (m) | Inflow Rate     | Readings          |      |                |                  | Depth Sealed (m) |                   |
|  |       |           |             | 1.00      | Concrete          |                                     |      | 15.00            |                  | Water Strike    |                   |      |                |                  |                  |                   |
| Groundwater Observations During Drilling |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
| Start of Shift                           |       |           |             |           |                   | End of Shift                        |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|  |       |           |             |           |                   | Date                                | Time | Depth Hole (m)   | Casing Depth (m) | Water Depth (m) | Water Level (mOD) | Time | Depth Hole (m) | Casing Depth (m) | Water Depth (m)  | Water Level (mOD) |
|  |       |           |             |           | Bentonite Seal    | 09/12/08                            |      |                  |                  |                 |                   |      | 30.00          |                  |                  |                   |
| Instrument Groundwater Observations      |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
| Inst. [A] Type :                         |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
| Instrument [A]                           |       |           |             |           |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |
|  |       |           |             | 19.00     | Slotted Standpipe | Date                                | Time | Depth (m)        | Level (mOD)      | Remarks         |                   |      |                |                  |                  |                   |
|  |       |           |             | 25.00     |                   |                                     |      |                  |                  |                 |                   |      |                |                  |                  |                   |

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**APPENDIX B**  
**SAMPLING RECORD SHEETS**

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## SAMPLING PROTOCOLS

(Adapted from the Landfill Manual: Landfill Monitoring,  
Environmental Protection Agency, 1995)



|  |                                    |
|--|------------------------------------|
| <b>Sampling Protocol For: Groundwater, Surface Water and Leachate.</b> |                                    |
| Compiled By: Peter Glanville (SLR)                                     |                                    |
| Protocol No. 01  | Version: 0                         |
| Issue date: 9 <sup>th</sup> January 2009                               | Supersedes Version – 0 (Jan. 2003) |
| Reasons for update – SLR Consulting Ireland                            |                                    |

### 1 *Background (to be completed)*

|  |                                    |
|--|------------------------------------|
| Sampling: (groundwater/surface water/leachate)   |                                    |
| Purpose of sample: Obtain baseline water quality sample for EIS  |                                    |
| Location: Milverton, Skerries, Co. Dublin  | Date: 7 <sup>th</sup> January 2009 |
| Client: RDL  | Protocol form completed by: PG     |
| Sampling Regime: (monthly/quarterly/annual): EIS   |                                    |
| Persons on site: (Client/Engineers/Contractors/Sub Consultants/ Others)<br>Peter Glanville and Tom Moore |                                    |
| Weather Conditions:<br>Very cold and sunny.  |                                    |

### 2 *Site Responsibilities (to be completed)*

|                                  |                                 |
|----------------------------------|---------------------------------|
| Supervision of sampling on Site: |                                 |
| Name: Peter Glanville            | Company: SLR Consulting Ireland |




**3 Locations Sampled (to be completed)**

| No. | Location ID | Date       | No. | Location ID | Date |
|-----|-------------|------------|-----|-------------|------|
| 1   | MW1         | 2009/01/08 | 21  |             |      |
| 2   | MW2         | 2009/01/08 | 22  |             |      |
| 3   | MW3         | 2009/01/08 | 23  |             |      |
| 4   | SW1         | 2009/01/08 | 24  |             |      |
| 5   |             |            | 25  |             |      |
| 6   |             |            | 26  |             |      |
| 7   |             |            | 27  |             |      |
| 8   |             |            | 28  |             |      |
| 9   |             |            | 29  |             |      |
| 10  |             |            | 30  |             |      |
| 11  |             |            | 31  |             |      |
| 12  |             |            | 32  |             |      |
| 13  |             |            | 33  |             |      |
| 14  |             |            | 34  |             |      |
| 15  |             |            | 35  |             |      |
| 16  |             |            | 36  |             |      |
| 17  |             |            | 37  |             |      |
| 18  |             |            | 38  |             |      |
| 19  |             |            | 39  |             |      |
| 20  |             |            | 40  |             |      |


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**4 Materials (to be completed)**

|  |  |
|--|--|
|   |  |
| <p><b>Instrumentation and Equipment:</b> (Equipment used to obtain a valid and representative sample of the medium being investigated, including equipment used to measure field parameters)</p> |  |
| <p>Pump/Bailer: Waterra Peristaltic Pump and high flow tubing</p>  |  |
| <p>Sample Bailers: Waterra Disposable Bailers</p>  | <p>Dip metre: 30m Electronic</p>                                       |
| <p>Equipment decontamination:</p>  |  |
| <p>Sample containers used:<br/>1l Glass, 1l Plastic, 125ml Plastic for Anions, 125ml Plastic with H2So4 preservative</p>   |  |
| <p>Field record sheets: Field Note Book</p>  | <p>Chain of custody documentation: 42032<br/>Laboratory: Alcontrol</p> |
| <p>Ancillary Items: (maps/drawings/stationary/PPE etc.)<br/>Standard PPE including latex gloves</p>  |  |

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5 *Methods (to be completed)*

|  |
|--|
| <p><b>Sampling Procedure:</b> (Stepwise procedure for sampling)</p> <div style="text-align: right;">  </div> <p>(a) Dip Well.</p> <p>(b) Purge well with Waterra pump and high flow tubing to obtain minimum of 3 no. well volumes where possible (i.e where well does not run dry).</p> <p>(c) Remove purging equipment and take water sample with disposable bailer.</p> <p>Equipment used for sampling: Disposable well bailers (Aquabailers/Clearview).</p> |
| <p>Procedure for labelling of samples:<br/>Client/Site/Sample ID/Date</p>  |
| <p>Sample Storage: Cooler box to Alcontrol Lab</p>   |
| <p>Sample collection and delivery to lab: Same day to ALcontrol Lab.</p>   |
| <p>Procedure for field parameter measurement:<br/>Sub Sample taken from well - field readings prior to sampling or at end of each well volume.</p> <p>Equipment used for measurement if field parameters: YSI Multiprobe meter; T (°C), EC (ms), DO (%), DO (mg/l), pH (pH units), pH mV, ORP.</p>   |

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6 Sample Plan (to be completed)

Sample details: For number and date of samples see Section 3.




Location of surface water samples:

| Location ID | Location                          | Location ID | Location |
|-------------|-----------------------------------|-------------|----------|
| SW1         | 50m upstream from Quarry entrance |             |          |
|             |                                   |             |          |
|             |                                   |             |          |

Frequency of sampling:

| No. | Sample ID | Depth of sample (m) | No. | Sample ID | Depth of sample (m) |
|-----|-----------|---------------------|-----|-----------|---------------------|
| 1   | MW1       | Na.                 | 19  |           |                     |
| 2   | MW2       | Na.                 | 20  |           |                     |
| 3   | MW3       | Na.                 | 21  |           |                     |
| 4   | SW1       | NA.                 | 22  |           |                     |
| 5   |           |                     | 23  |           |                     |
| 6   |           |                     | 24  |           |                     |
| 7   |           |                     | 25  |           |                     |
| 8   |           |                     | 26  |           |                     |
| 9   |           |                     | 27  |           |                     |
| 10  |           |                     | 38  |           |                     |
| 11  |           |                     | 39  |           |                     |
| 12  |           |                     | 30  |           |                     |
| 13  |           |                     | 31  |           |                     |
| 14  |           |                     | 32  |           |                     |
| 15  |           |                     | 33  |           |                     |
| 16  |           |                     | 34  |           |                     |
| 17  |           |                     | 35  |           |                     |
| 18  |           |                     | 36  |           |                     |

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|                                    |  |   |
|------------------------------------|--|---|
| Quantity Sample Obtained.          |  |  |
| Sample volume: 2.5l                |  |   |
| Sample container type and no.:     | 1l Glass<br>1l Plastic<br>1 125ml plastic (Anions)<br>1 125ml plastic H2SO4 preservative |   |
| Sample preservatives used (if any) | H2SO4  |   |

**7 Records (to be completed at end of sampling round)**

|   |                  |
|---|------------------|
| <b>QA Records:</b> The following records are required to demonstrate sampling protocol has been adhered to (check Box). |                  |
| <b>Record of:</b>   | <b>Completed</b> |
| Date of sampling  | ✓                |
| Name of sampling personnel  | ✓                |
| Weather conditions  | ✓                |
| Amount of sample obtained   | ✓                |
| Location sample points  | ✓                |
| Sample preservatives used   | ✓                |
| Results of field parameters (see site record of groundwater sampling sheet)   | ✓                |
| Compilation of appropriate forms (i.e. site record, sampling sheet, chain of custody form)                              | ✓                |
| Deviations from protocol (see notes)  | ✓                |
| Sampling difficulties (see notes)   | ✓                |
|   |                  |

8 *Comments***Notes:**

**Well MW1:** Well was pumped dry after 35l. Left to recharge for 30 min. and a further 8-10l was purged. Purged water was light brown in colour. Sampled.

**Well MW2:** Well was pumped dry after 35l. Left to recharge for 30 min. and a further 10l was purged. Purged water was light brown in colour. Returned to take sample after sampling after purging well MW1. Sampled

**Well MW3:** 120l purged from the well. Field readings were taken every 40l. Water purged was very brown and slightly sandy. Sampled.

**Surface Water SW1:** Sample of surface water taken from the stream opposite the site entrance. Access to the stream us via a farm gate and small bridge approximately 50m upstream from the site entrance.

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## Groundwater Sampling Field Record Sheet

SLR Consulting Ireland Ltd.,  
Unit 7, Dundrum Business Park,  
Windy Arbour, Dublin 14.



### RECORD OF GROUNDWATER SAMPLING

|                                      |                  |
|--------------------------------------|------------------|
| Site Location: Milverton, Co. Dublin | SLR Job No. 3933 |
| Date/Time: 08/01/2009                |                  |
| Borehole ID. BH01                    |                  |
| Borehole Location: Quarry            |                  |
| Engineer: SLR                        | Sub Consultant:  |
|                                      |                  |

### WELL DETAILS

|  |           |
|--|-----------|
| Elevation of steel casing cover above ground level (m) | 0.99      |
| Groundwater level from ground level (m)                | 14.31 bgl |
| Depth of well from ground level (m)                    | 22        |
| Standpipe diameter (mm)                                | 50mm      |
| Well Volume (m <sup>3</sup> )                          | 45 l      |

|                  |                       |
|------------------|-----------------------|
| Well Development | Volume removed (l) 40 |
|------------------|-----------------------|

### WELL PURGING (see Field Parameters Sheet)

| Purge volume | pH   | EC (µS) | Temp (°C) | Dissolved Oxygen (mg/l) | ORP    |
|--------------|------|---------|-----------|-------------------------|--------|
| 40 l         | 7.89 | 739     | 9.8       | 9.28                    | -197.9 |
|              |      |         |           |                         |        |
|              |      |         |           |                         |        |
|              |      |         |           |                         |        |

**Notes:** Purged using Waterra Inertial Pump, and dedicated Waterra Tubing

**Visual inspection:**

**Odour:** None

**Colour:** Purged groundwater was light brown and slightly silty.

**Sheen:** No oil sheen or film.



## Groundwater Sampling Field Record Sheet

SLR Consulting Ireland Ltd.,  
Unit 7, Dundrum Business Park,  
Windy Arbour, Dublin 14.



### RECORD OF GROUNDWATER SAMPLING

|                                      |                  |
|--------------------------------------|------------------|
| Site Location: Milverton, Co. Dublin | SLR Job No. 3933 |
| Date/Time: 08/01/2009                |                  |
| Borehole ID: BH02                    |                  |
| Borehole Location: Quarry            |                  |
| Engineer: SLR                        | Sub Consultant:  |
|                                      |                  |

### WELL DETAILS

|  |           |
|--|-----------|
| Elevation of steel casing cover above ground level (m) | 0.94      |
| Groundwater level from ground level (m)                | 10.82 bgl |
| Depth of well from ground level (m)                    |           |
| Standpipe diameter (mm)                                | 50mm      |
| Well Volume (m <sup>3</sup> )                          | - l       |

|                  |                        |
|------------------|------------------------|
| Well Development | Volume removed (l) 120 |
|------------------|------------------------|

### WELL PURGING (see Field Parameters Sheet)

| Purge volume | pH   | EC (µS) | Temp (°C) | Dissolved Oxygen (mg/l) | ORP  |
|--------------|------|---------|-----------|-------------------------|------|
| 40 l         | 7.71 | 990     | 10.07     | 7.55                    | 84   |
| 80 l         | 7.53 | 979     | 10.78     | 6.95                    | 82.1 |
| 120 l        | 7.42 | 943     | 10.6      | 6.77                    |      |
|              |      |         |           |                         |      |
|              |      |         |           |                         |      |

**Notes:** Purged using Clearview disposable bailer

**Visual inspection** Very silty and slightly sandy

**Odour:** None

**Colour:** Silty

**Oil Sheen:** None

## Groundwater Sampling Field Record Sheet

SLR Consulting Ireland Ltd.,  
Unit 7, Dundrum Business Park,  
Windy Arbour, Dublin 14.



### RECORD OF GROUNDWATER SAMPLING

|                                      |                  |
|--------------------------------------|------------------|
| Site Location: Milverton, Co. Dublin | SLR Job No. 3933 |
| Date/Time: 08/01/2009                |                  |
| Borehole ID: BH03                    |                  |
| Borehole Location: Quarry            |                  |
| Engineer: SLR                        | Sub Consultant:  |
|                                      |                  |

### WELL DETAILS

|  |           |
|--|-----------|
| Elevation of steel casing cover above ground level (m) | 1.085     |
| Groundwater level from ground level (m)                | 12.18 bgl |
| Depth of well from ground level (m)                    | 23        |
| Standpipe diameter (mm)                                | 50mm      |
| Well Volume (m <sup>3</sup> )                          | 62 l      |

|                  |                       |
|------------------|-----------------------|
| Well Development | Volume removed (l) 30 |
|------------------|-----------------------|

### WELL PURGING (see Field Parameters Sheet)

| Purge volume | pH   | EC (µS) | Temp (°C) | Dissolved Oxygen (mg/l) | ORP  |
|--------------|------|---------|-----------|-------------------------|------|
| 30 l         | 7.61 | 968     | 10.48     | 6.81                    | -295 |
|              |      |         |           |                         |      |
|              |      |         |           |                         |      |
|              |      |         |           |                         |      |

**Notes:** Purged using Clearview disposable bailer

**Visual inspection** Silty and slightly sandy

**Odour:** None

**Colour:** Silty

**Oil Sheen:** None

**APPENDIX C**

**HYDROCHEMICAL TEST RESULTS**

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**CERTIFICATE OF ANALYSIS**

**Client:** SLR Consulting Ltd.  
Treenwood House  
Rowden Lane  
Bradford On Avon  
Wiltshire  
BA15 2AU

**Attention:** Peter Glanville

**Date:** 19 January, 2009

**Our Reference:** 09-B00061/01

**Your Reference:** SO1.0059.0021

**Location:** MILVERTON EIS

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A total of 4 samples was received for analysis on Thursday, 8 January 2009. 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**

*Caoimhe McLoughlin*  
.....  
*Caoimhe McLoughlin*



# ALcontrol Laboratories Ireland

## Test Schedule

Ref Number: 09-B00061/01

Client: SLR Consulting Ltd.

Date of Receipt: 08/01/2009

Sample Type: WATER

Location: MILVERTON EIS

Client Contact: Peter Glanville

Client Ref: SO1.0059.0021

| Detection Method                              |                 |          |                            | 5 DAY ATU      | GC                    | GC                | GC                 | GC      | GC           | GC                          | GC                           | GC      | GC           | ICP MS         | ICP MS                        | ICP MS                      | ICP MS                        |
|---|-----------------|----------|----------------------------|----------------|-----------------------|-------------------|--------------------|---------|--------------|-----------------------------|------------------------------|---------|--------------|----------------|-------------------------------|-----------------------------|-------------------------------|
| UKAS Accredited [Testing Laboratory] No. 1291 |                 |          |                            | ✓              | ✓                     |                   |                    | ✓       | ✓            | ✓                           | ✓                            | ✓       |              | ✓              | ✓                             | ✓                           | ✓                             |
| ALcontrol Reference                           | Sample Identity | Other ID | P / V                      | BOD Unfiltered | Diesel Range Organics | Mineral Oil by GC | DRO Interpretation | Benzene | Ethylbenzene | Petrol Range Organics C5-C9 | Petrol Range Organics C10-12 | Toluene | Total Xylene | Total Hardness | Dissolved Magnesium Low Level | Dissolved Calcium Low Level | Dissolved Manganese Low Level |
| 09-B00061-S0010-A01                           | MW1             | UNKNOWN  | Glass Bottle               | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0010-A03                           | MW1             | UNKNOWN  | Plastic Bottle             | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | X              | X                             | X                           | X                             |
| 09-B00061-S0010-A08                           | MW1             | UNKNOWN  | Plastic Bottle + H2SO4     | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0010-A10                           | MW1             | UNKNOWN  | 100ml Plastic Anion Bottle | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0011-A01                           | MW2             | UNKNOWN  | Glass Bottle               | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0011-A03                           | MW2             | UNKNOWN  | Plastic Bottle             | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | X              | X                             | X                           | X                             |
| 09-B00061-S0011-A08                           | MW2             | UNKNOWN  | Plastic Bottle + H2SO4     | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0011-A10                           | MW2             | UNKNOWN  | 100ml Plastic Anion Bottle | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0012-A01                           | MW3             | UNKNOWN  | Glass Bottle               | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0012-A03                           | MW3             | UNKNOWN  | Plastic Bottle             | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | X              | X                             | X                           | X                             |
| 09-B00061-S0012-A08                           | MW3             | UNKNOWN  | Plastic Bottle + H2SO4     | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0012-A10                           | MW3             | UNKNOWN  | 100ml Plastic Anion Bottle | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0013-A01                           | SW1             | UNKNOWN  | Glass Bottle               | -              | X                     | -                 | X                  | X       | X            | X                           | X                            | X       | X            | -              | -                             | -                           | -                             |
| 09-B00061-S0013-A05                           | SW1             | UNKNOWN  | Plastic Bottle             | X              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | X              | X                             | X                           | X                             |
| 09-B00061-S0013-A11                           | SW1             | UNKNOWN  | Plastic Bottle + H2SO4     | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |
| 09-B00061-S0013-A13                           | SW1             | UNKNOWN  | 100ml Plastic Anion Bottle | -              | -                     | -                 | -                  | -       | -            | -                           | -                            | -       | -            | -              | -                             | -                           | -                             |

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

# ALcontrol Laboratories Ireland

## Test Schedule

Ref Number: 09-B00061/01

Client: SLR Consulting Ltd.

Date of Receipt: 08/01/2009

Sample Type: WATER

Location: MILVERTON EIS

Client Contact: Peter Glanville

Client Ref: SO1.0059.0021

| Detection Method                              |                 |          |                                    | ICP MS                   | ICP MS                        | ICP OES             | ICP OES          | IR                   | KONE                       | KONE                               | KONE                       | KONE     | KONE     | SPECTRO                  | TITRATION                             |   |   |
|---|-----------------|----------|------------------------------------|--------------------------|-------------------------------|---------------------|------------------|----------------------|----------------------------|------------------------------------|----------------------------|----------|----------|--------------------------|---------------------------------------|---|---|
| UKAS Accredited [Testing Laboratory] No. 1291 |                 |          |                                    | ✓                        | ✓                             |                     |                  | ✓                    | ✓                          | ✓                                  | ✓                          | ✓        | ✓        | ✓                        | ✓                                     |   |   |
| Alcontrol Reference                           | Sample Identity | Other ID | P / V                              | Dissolved Iron Low Level | Dissolved Aluminium Low Level | Dissolved Potassium | Dissolved Sodium | Total Organic Carbon | Nitrate as NO <sub>3</sub> | ortho Phosphate as PO <sub>4</sub> | Nitrite as NO <sub>2</sub> | Chloride | Sulphate | Ammoniacal Nitrogen as N | Total Alkalinity as CaCO <sub>3</sub> |   |   |
| 09-B00061-S0010-A01                           | MW1             | UNKNOWN  | Glass Bottle                       | -                        | -                             | -                   | -                | X                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | - | - |
| 09-B00061-S0010-A03                           | MW1             | UNKNOWN  | Plastic Bottle                     | X                        | X                             | X                   | X                | -                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | X | - |
| 09-B00061-S0010-A08                           | MW1             | UNKNOWN  | Plastic Bottle + H2SO <sub>4</sub> | -                        | -                             | -                   | -                | -                    | -                          | -                                  | -                          | -        | -        | -                        | X                                     | - | - |
| 09-B00061-S0010-A10                           | MW1             | UNKNOWN  | 100ml Plastic Anion Bottle         | -                        | -                             | -                   | -                | -                    | X                          | X                                  | X                          | X        | X        | -                        | -                                     | - | - |
| 09-B00061-S0011-A01                           | MW2             | UNKNOWN  | Glass Bottle                       | -                        | -                             | -                   | -                | X                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | - | - |
| 09-B00061-S0011-A03                           | MW2             | UNKNOWN  | Plastic Bottle                     | X                        | X                             | X                   | X                | -                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | X | - |
| 09-B00061-S0011-A08                           | MW2             | UNKNOWN  | Plastic Bottle + H2SO <sub>4</sub> | -                        | -                             | -                   | -                | -                    | -                          | -                                  | -                          | -        | -        | -                        | X                                     | - | - |
| 09-B00061-S0011-A10                           | MW2             | UNKNOWN  | 100ml Plastic Anion Bottle         | -                        | -                             | -                   | -                | -                    | X                          | X                                  | X                          | X        | X        | -                        | -                                     | - | - |
| 09-B00061-S0012-A01                           | MW3             | UNKNOWN  | Glass Bottle                       | -                        | -                             | -                   | -                | X                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | - | - |
| 09-B00061-S0012-A03                           | MW3             | UNKNOWN  | Plastic Bottle                     | X                        | X                             | X                   | X                | -                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | X | - |
| 09-B00061-S0012-A08                           | MW3             | UNKNOWN  | Plastic Bottle + H2SO <sub>4</sub> | -                        | -                             | -                   | -                | -                    | -                          | -                                  | -                          | -        | -        | -                        | X                                     | - | - |
| 09-B00061-S0012-A10                           | MW3             | UNKNOWN  | 100ml Plastic Anion Bottle         | -                        | -                             | -                   | -                | -                    | X                          | X                                  | X                          | X        | X        | -                        | -                                     | - | - |
| 09-B00061-S0013-A01                           | SW1             | UNKNOWN  | Glass Bottle                       | -                        | -                             | -                   | -                | -                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | - | - |
| 09-B00061-S0013-A05                           | SW1             | UNKNOWN  | Plastic Bottle                     | X                        | X                             | X                   | X                | -                    | -                          | -                                  | -                          | -        | -        | -                        | -                                     | X | - |
| 09-B00061-S0013-A11                           | SW1             | UNKNOWN  | Plastic Bottle + H2SO <sub>4</sub> | -                        | -                             | -                   | -                | -                    | -                          | -                                  | -                          | -        | -        | -                        | X                                     | - | - |
| 09-B00061-S0013-A13                           | SW1             | UNKNOWN  | 100ml Plastic Anion Bottle         | -                        | -                             | -                   | -                | -                    | X                          | X                                  | X                          | X        | X        | -                        | -                                     | - | - |

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

# ALcontrol Laboratories Ireland

## Test Schedule Summary

Ref Number: **09-B00061/01**  
 Client: SLR Consulting Ltd.  
 Date of Receipt: 08/01/2009

Sample Type: **WATER**  
 Location: MILVERTON EIS  
 Client Contact: Peter Glanville  
 Client Ref: SO1.0059.0021

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

| SCHEDULE | METHOD    | TEST NAME                     | TOTAL |
|----------|-----------|-------------------------------|-------|
| X        | 5 DAY ATU | BOD Unfiltered                | 1     |
| X        | GC        | DRO + Mineral Oil by GC       | 1     |
| X        | GC        | DRO Interpretation            | 1     |
| X        | GC        | PRO & BTEX                    | 1     |
| X        | ICP MS    | Total Hardness (ICP MS)       | 4     |
| X        | ICP MS    | Dissolved Aluminium Low Level | 4     |
| X        | ICP MS    | Dissolved Calcium Low Level   | 4     |
| X        | ICP MS    | Dissolved Iron Low Level      | 4     |
| X        | ICP MS    | Dissolved Magnesium Low Level | 4     |
| X        | ICP MS    | Dissolved Manganese Low Level | 4     |
| X        | ICP OES   | Dissolved Potassium           | 4     |
| X        | ICP OES   | Dissolved Sodium              | 4     |
| X        | IR        | Total Organic Carbon          | 3     |
| X        | KONE      | Chloride                      | 4     |
| X        | KONE      | Nitrate as NO3                | 4     |
| X        | KONE      | Nitrite as NO2                | 4     |
| X        | KONE      | ortho Phosphate               | 4     |
| X        | KONE      | Sulphate                      | 4     |
| X        | SPECTRO   | Ammoniacal Nitrogen           | 4     |
| X        | TITRATION | Total Alkalinity              | 4     |

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**Geochem Analytical Services**  
 Diesel Range Organics/Mineral Oil  
 by  
 G.C.

Client Name SLR Consulting Ltd.  
 Client Ref SO1.0059.0021  
 Sample Matrix Water

Job Number B00061  
 Date Extracted/Prepared 13.01.09  
 Date Analysed 14.01.09

Separatory Funnel Ext No  
 Soxtec Extraction No  
 Column Extraction No

| Sample number | Sample Identity | Depth | Diesel Range Hydrocarbons | Mineral Oil | Interpretation             |
|---------------|-----------------|-------|---------------------------|-------------|----------------------------|
|               |                 |       | (µg/litre)                | (µg/litre)  |                            |
| 013           | SW1             | -     | < 10                      | < 10        | No Identification Possible |

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Checked by Magda Dziedzic

## 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.

Last updated February 2005