

## 5 SOILS, GEOLOGY AND HYDROGEOLOGY

### 5.1 INTRODUCTION

The proposed MBT Facility site is located in a large Bord na Móna landholding in the townlands of Coolcarrigan and Drummond, Carbury, Co. Kildare. The entire Bord na Móna landholding, comprising 2,544ha, is divided into a northern portion of 799ha and a southern portion of 1,745ha. The northern portion and southern portions of the Bord na Móna property are divided by the L5025 County Road, which crosses the narrowest section of the peat deposit.

The soils and geology assessment concentrated on the characterisation of the soil and geology environment within the footprint of the proposed MBT facility. Significant information is available from the nearby Bord na Móna Drehid Waste Management Facility site (EPA Waste licence No. W0201-03), which contributed to this assessment.

The entire Bord na Móna landholding in this area has been utilised for the industrial harvesting of peat over an approximate 50 year period, therefore the soil environment is characterised at its current state, which is significantly altered from its original setting.

The baseline assessment of the soils and geology is concerned with an appraisal and description of the deposits within the MBT Facility site. The information contained in this section has been divided into sub-sections, so as to describe the various aspects pertaining to soil and geology. The sub-terrain environment is described from the surface down, to describe and conceptualise the different layers occurring under the MBT Facility site. The groundwater movement through the various sub-terrain media is also described.

### 5.2 METHODOLOGY

This report has been prepared using the recommendations set out in the Environmental Protection Agency (EPA) document 'Guidelines on Information to be contained in Environmental Impact Statements' (2002). The guidelines and recommendations of the Institute of Geologists of Ireland (IGI) 2002 publication 'Geology in Environmental Impact Statements – A Guide' was also taken into account in the preparation of this section.

In the preparation of this section, all available relevant regional and site specific information was collated and assessed. The information sources are detailed further herein.

All projects and developments that require an EIS are of a scale or nature that they have the potential to have an impact on the environment. In this section the potential impact on the geological environment resulting from development of the proposed MBT facility is assessed and mitigation measures are proposed to reduce any significant impacts. Based on the mitigation measures proposed the significance of the predicted impact on the geological environment is determined.

Various relevant datasets and information sources were used in the compilation of this section of the EIS, including:

- Reference to existing regional and site specific topography maps from the Ordnance Survey of Ireland (OSI) publications and from surveys undertaken on behalf of the Client;
- The regional soil, subsoil, geological and hydrogeological maps available from the Geological Survey of Ireland (GSI) which were used to determine the setting of the MBT Facility site, such as the 1:100,000 scale Bedrock Geology Sheet No. 16 (Geology of Kildare/Wicklow), GSI 1995;
- Previous site investigation data at the Bord na Móna landholding;
- A site investigation of ground conditions to determine site-specific ground conditions within the boundary of the proposed MBT development; and
- A site walkover undertaken in November 2011 and January 2012.

The aim of the site investigation was to determine the ground conditions at the proposed location of the MBT facility. The site investigation works helped to identify potential impacts arising from the formation of the access roads, construction of buildings and the installation of associated facilities. Based on the investigation findings discussed and the likely impacts and risks that may be anticipated, guidance is provided towards the mitigation of these impacts and minimisation of the associated risks during construction and operation.

This chapter should be regarded as being a distillation of the likely issues relating to impacts on the geological and hydrogeological environment, together with appropriate construction and operational recommendations to mitigate the impacts.

### 5.3 EXISTING ENVIRONMENT

#### 5.3.1 Soil and Subsoil Geology

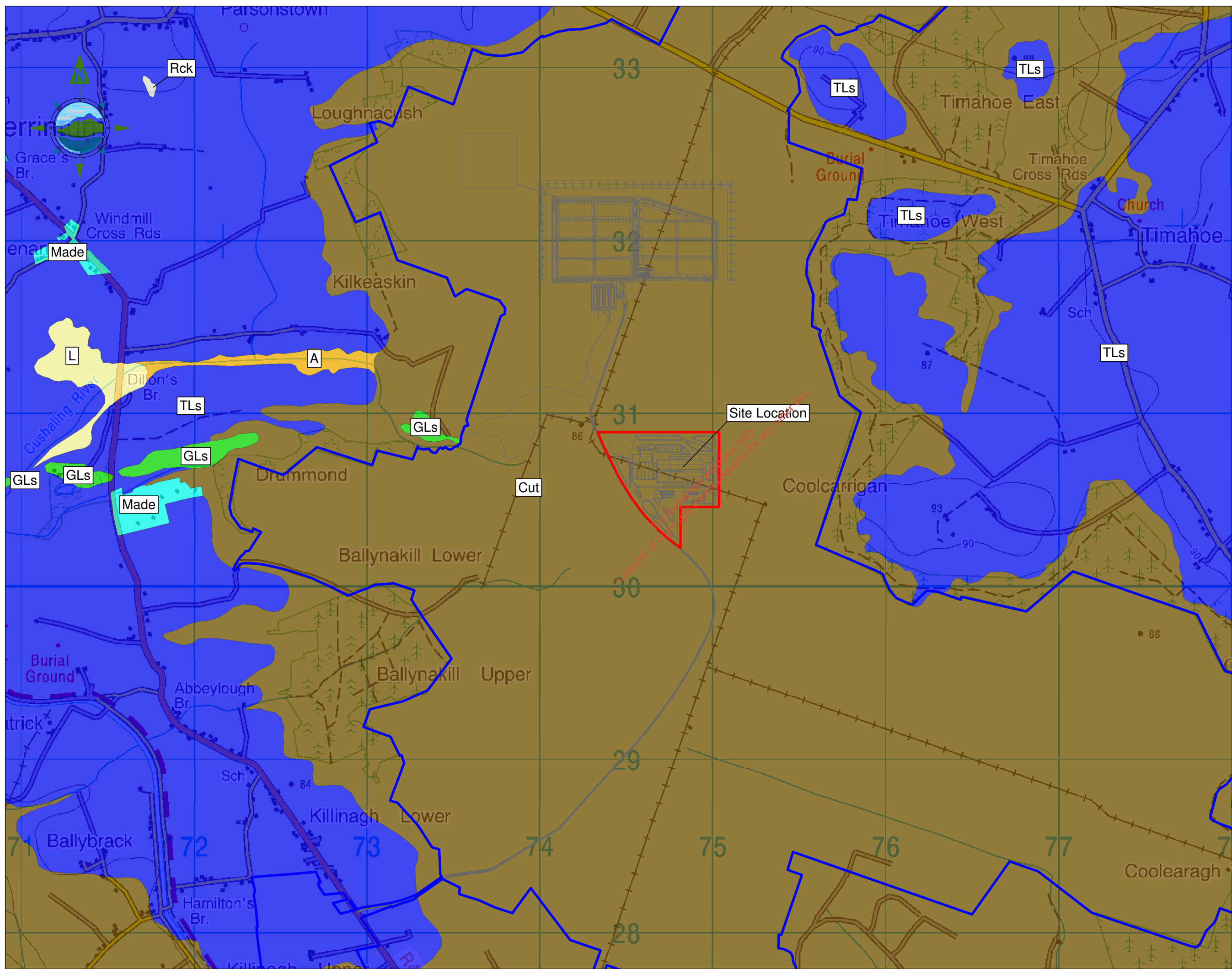
The distribution of soil types in the vicinity of the MBT Facility site is shown on Figure 5.1, which is an extract from the Soils Map of Ireland, prepared by the National Soil Survey (1980). The soil map indicates that the principal dominant soil within the MBT Facility site comprises peat deposits.

The origin of the unconsolidated materials in this area is associated with the movement and deposition from the Irish Ice Sheet during the last Ice Age. The last Ice Age occurred during the Quaternary Period (1.6 million years to 10,000 years ago), which is the most recent period in the geological timeframe.

The Quaternary map (2004), produced by the GSI as part of the Groundwater Protection Scheme for County Kildare, indicates that all lands within the MBT facility activity boundary are covered with peat deposits (Figure 5.1). This is supported by the Teagasc Subsoil (Parent Material) dataset which is available on the GSI website. The freer draining lands on the verge of Bord na Móna's landholding are underlain by '*Till chiefly derived from Limestone*' (GSI website). This limestone till is known to underlie the peat material within the MBT Facility site.

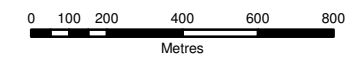
Reference to the 19<sup>th</sup> century, 6-inch to 1-mile scale, field sheets indicates that the till comprises Clay and Gravel, with sporadic isolated lenses of Sand and Gravel interbedded with the till. The field sheets do not record any rock outcrops in the vicinity of the applicant's property.

Information available from the GSI open file records indicates that a number of mineral exploration boreholes were drilled in this area and data on the depth to bedrock is available from these records. These GSI records indicate that the Quaternary deposits are quite thick in this area with the depth to bedrock varying between 10m and 35m in the vicinity of the proposed MBT facility site. Site investigation data is outlined in section 5.3.2 and supports the above findings.



**Legend**

- Site Boundary
- Landownership Boundary
- A Alluvium
- Cut Cutover Peat
- GLs Limestone sands and gravels (Carboniferous)
- L Lake sediments undifferentiated
- Made Made ground
- Rck Bedrock at surface
- TLs Limestone till (Carboniferous)



- NOTES**
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
  2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
  3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
  4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
A	05.06.12	Issued for Waste License	G.F.	J.D.

Client:  
**BORD NA MÓNA**

Project:  
DREHID  
MECHANICAL BIOLOGICAL  
TREATMENT (MBT) FACILITY

Title:  
SUBSOILS GEOLOGY  
MAP

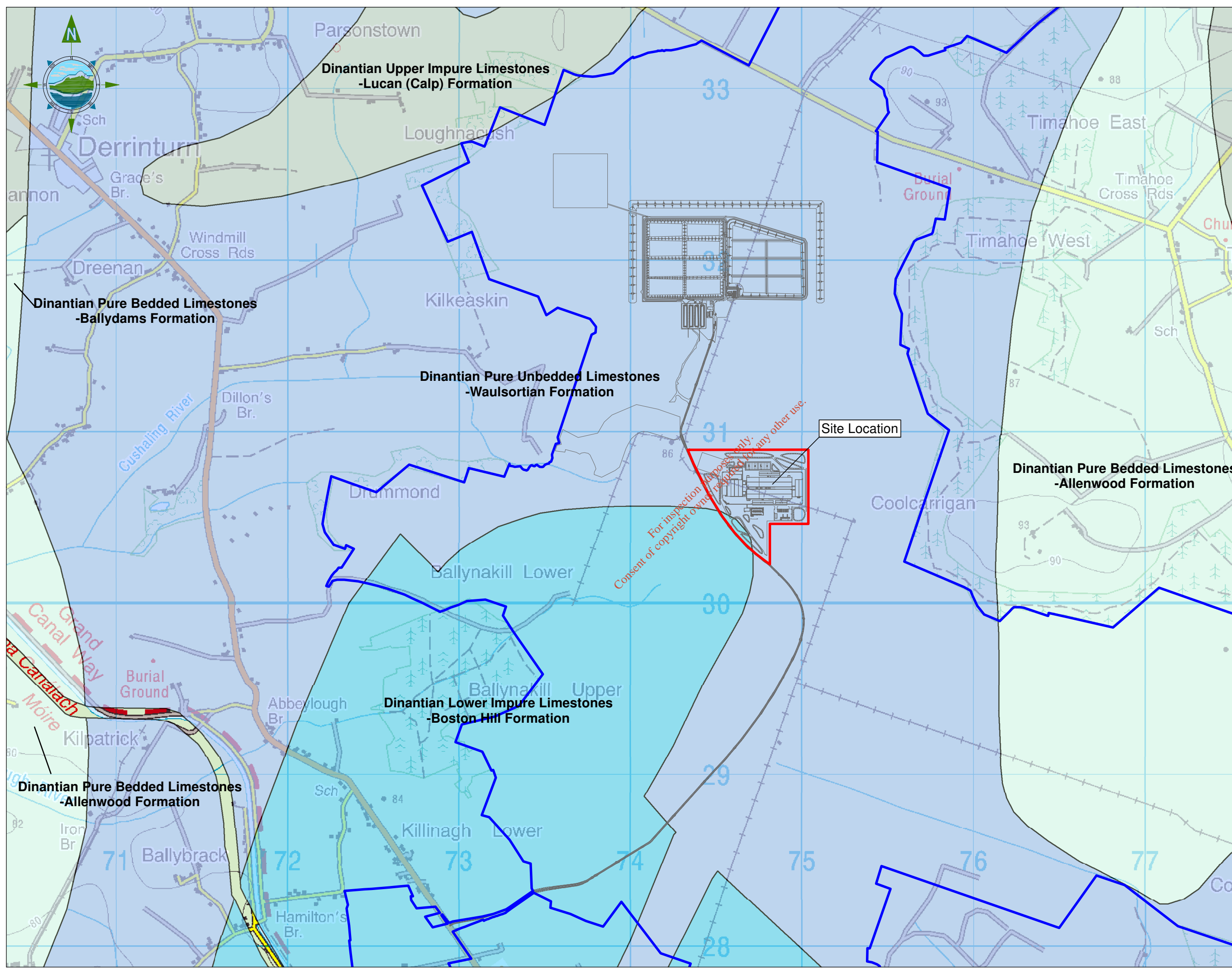
Scale @ A3: 1:20,000

Prepared by: G.Fil      Checked: J.Dillon      Date: May 2012

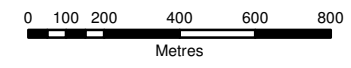
Project Director: D.Grehan

**TOBIN**  
Patrick J. Tobin & Co. Ltd.  
Consulting, Civil and Structural Engineers,  
Block 10-4, Blanchardstown Corporate Park,  
Dublin 15, Ireland.  
tel: +353-(0)1-8030406  
fax: +353-(0)1-8030409  
e-mail: info@tobin.ie  
www.tobin.ie

Figure 5.1 6301  
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- Legend**
- Site Boundary
  - Landownership Boundary
  - Dinantian Lower Impure Limestones
  - Dinantian Pure Bedded Limestones
  - Dinantian Pure Unbedded Limestones
  - Dinantian Upper Impure Limestones



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Client:  
**BORD NA MÓNA**

Project:  
 DREHID  
 MECHANICAL BIOLOGICAL  
 TREATMENT (MBT) FACILITY

Title:  
 BEDROCK GEOLOGY  
 MAP

Scale @ A3: 1:20,000

Prepared by: G.Fil      Checked: J.Dillon      Date: May 2012

Project Director: D.Grehan

Patrick J. Tobin & Co. Ltd.  
 Consulting, Civil and Structural Engineers,  
 Block 10-4, Blanchardstown Corporate Park,  
 Dublin 15, Ireland.  
 tel: +353-(0)1-8030406  
 fax: +353-(0)1-8030409  
 e-mail: info@tobin.ie  
 www.tobin.ie

Figure 5.2  
 A

### 5.3.2 Bedrock Geology

Reference to the most recently published geological map for this area, the 1:100,000 scale Sheet 16 – Geology of Kildare/Wicklow (GSI 1995), indicates that this area of County Kildare is underlain by Carboniferous aged (355 million years to 290 million years ago) limestone deposits.

The Carboniferous bedrock forms low elevation ground and is covered by overburden deposits. Outcrops of Carboniferous bedrock are scarce in the vicinity of the MBT facility site. The current understanding of the bedrock geology in this area is based on the extensive exploration boreholes that have been drilled within the Bord na Móna landholding and the surrounding area.

Figure 5.2 is an extract from the GSI Sheet 16 publication and shows the lithological distribution in the vicinity of the MBT Facility site and the broader succession groups, which are described below.

The Carboniferous (Dinantian) limestone succession underlying the MBT Facility was deposited in a shallow water shelf environment, which is referred to as the ‘Kildare Shelf’ succession. The ‘Kildare Shelf’ succession is bound to the west by the ‘Portarlinton Trough’ succession and to the north by the ‘Dublin Basin’ succession. The Portarlinton Trough and the Dublin Basin successions are described as basin successions that were deposited in a deeper marine environment following erosion of the Kildare Shelf succession. The Kildare Shelf succession in the vicinity of the MBT Facility site, based on the geological map, comprises the Boston Hill Formation, the Waulsortian Limestone Formation and the Allenwood Formation.

- The Boston Hill Formation comprises rather uniform, thick successions of nodular and diffusely bedded, Dinantian argillaceous limestones (fine grained limestone, comprising predominantly clay minerals) and subordinate thin shales. The contact with the Waulsortian Limestone Formation is gradational.
- The Waulsortian Limestone Formation consists mainly of pale grey biomicrite (a limestone consisting of skeletal debris and carbonate mud). The sediments commonly form individual and coalesced mounds with depositional dips of 30-40 degrees.
- The Allenwood Formation comprises peloidal and crinoidal limestone and minor oolite at the base with micrites, overlying minor shales and mainly pelsparite (limestone consisting of peloids and spary-calcite) at the top of the succession. The Edenderry Oolite Member, which is part of the Allenwood Formation, is not distinguished on all locations on the map due to its irregular distribution. The Ballyadams Formation comprised of pale well bedded fossiliferous Dinantian age limestone, is located 3.7km to the west of the MBT Facility site.

- The Dublin Basin depositional succession and the Portarlinton Trough depositional succession are dominated by the Calp Limestones. The term 'Calp' is used to refer to the various basinal limestone and shales occurring in these successions. The Calp units generally consist of dark grey, fine grained, graded Dinantian age limestones with interbedded black shales. The variation in bed thickness, grain size, colour and proportion of shale is a feature of the depositional environment in which these sediments were deposited in the basin.
- The structural geology of the Carboniferous Limestones is poorly understood and any faults shown on the geological map are considered to be very tentative, as indicated by the GSI. The poorly understood tectonics is due to the poor control of the bedrock geology as a result of the lack of outcrop exposure.

Site investigation data is outlined in section 5.3.2 below and supports the geological description of the area.

### 5.3.3 *Geological information gathered from Site-Specific Investigations*

#### **Soils and Subsoils**

Visual assessment of the MBT Facility site indicates that peat deposits occur across the entire MBT Facility site. Peat is a soil that is made up of the partially decomposed remains of dead plants that have accumulated on top of each other in waterlogged conditions over thousands of years. Peat is brownish-black in colour and in its natural state is composed of 90-95% water and 5-10% solid organic material.

Industrial harvesting of the peat deposits has occurred in the past within the MBT Facility site. In order to allow for such harvesting of the peat a network of large drains was opened up across the bog to reduce the moisture content of the material, thus allowing the land to be traversed by specialist plant and machinery. The appearance of the bog is heavily influenced by the drainage network, which divides the bog into a number of compartments. The topography of the MBT Facility site is heavily influenced by the previous industrial activity, where the harvesting has resulted in a relatively flat relief across the MBT Facility site. In addition, an unused railway track (previously used by Bord na Móna for the transport of peat) traverses the northern section of the proposed MBT facility.

The remaining peat deposits within the MBT Facility site have been investigated on a number of occasions using different intrusive and non-intrusive methods. As part of the site investigation programme undertaken by TOBIN in 2011, the peat thickness was investigated by the excavation of 21 No. trial pits and 6 No. boreholes (Refer to Figure 5.4 and Appendix 5.1 for details).

The proposed MBT Facility and associated infrastructure has been positioned to, inter alia, minimise the volume of peat that is required to be removed. Peat has already been removed largely by the industrial harvesting of peat and the presence of a former peat railway track to the north of the proposed MBT Facility site. The locations of all trial pits and boreholes, are shown on Figure 5.3 and 5.4, with the descriptive logs contained in Appendix 5.1. The trial pit depths varied within the range of 3.0 m to 3.5 m below ground level (bgl). Most trial pits were terminated at 3.5 m bgl or when collapsing side walls or obstructions were encountered at depth. Bedrock was not encountered in any trial pits excavated within the MBT Facility site. The thickness of peat within the MBT site varies from 0.4 m to a maximum of 2.6m based on trial pit and borehole site investigation information. The average thickness across the proposed MBT facility footprint is 1.2m.

The contact between the peat deposits and the underlying glacial subsoil is very pronounced, with a sharp change between the two materials. The subsoils, which underlie the MBT Facility site, are predominantly fine grained. The composition of the subsoil, recorded from each trial pit, was relatively consistent across the MBT Facility site, with some notable exceptions. In a number of trial pits, a thin horizon of shell marl was evident. Underlying the peat, the subsoils encountered in the trial pits are comprised of grey to blue grey, silts, clays and silt/clay with occasional to frequent sub-angular to sub-rounded gravels and cobbles. The stiffness of the silt/clay material typically increased with depth.

Occasional lenses of sand and gravel are present within the silt/clay material at the proposed MBT facility site. The sand ranges from medium to coarse grained and is quite silty. Occasional bands of clean gravel were also encountered. The gravel clasts vary from sub-rounded to well rounded, with clasts generally ranging from pebble to cobble size.



### Bedrock Geology

Bedrock was not encountered in any boreholes or trial pits undertaken in 2011. Previous site investigation works in the surrounding area encountered bedrock between 9 m bgl (GW3D) and 15 m bgl (GW2D). The depth to bedrock under the proposed MBT facility site is greater than 10 m bgl.

The depth to bedrock is in accordance with the GSI geological map. Waulsortian limestone, which comprises pale grey, fine grained limestone, was encountered throughout most of the Bord na Mona landholding (boreholes GW1D, GW4D and GW6).

The site specific borehole information suggests that the contact between the Boston Hill Formation and the Waulsortian Limestone Formation extends further to the east than shown on the GSI geology map. As the bedrock at the base of borehole GW 7 is the Edenderry member, the lithological divide between the Waulsortian and the Allenwood Formation extends further west than shown on the GSI geology map. Notwithstanding the difference in the lithological divides between the Waulsortian Limestone Formation and the Boston Hill Formation/Allenwood Formation, the borehole drilling is generally consistent with the GSI geology map.

#### *5.3.4 Geotechnical analysis of subsoil material*

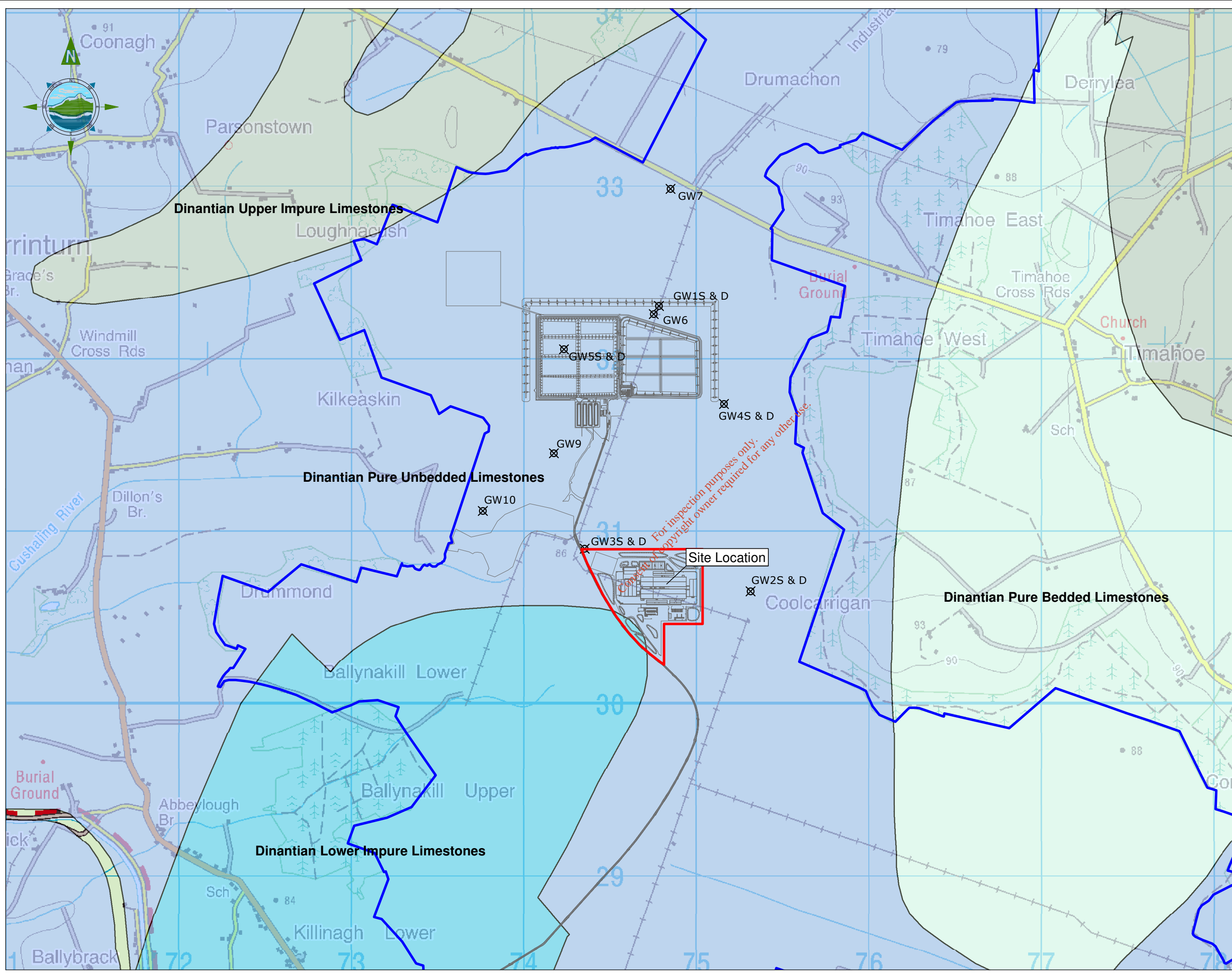
Geotechnical samples of the quaternary subsoil material were obtained during site investigation works conducted in 2011. A total of 12 No. disturbed samples were obtained to determine the particle size distribution (PSD) of the unconsolidated material from boreholes BH1–BH6 and from trial pits TP31 and TP38. These samples are considered to be representative of the fine grained subsoil (SILT, SILT/CLAY, CLAY) that dominates within the proposed MBT Facility site. Disturbed bulk samples of the gravel horizons from BH3 and BH5 were also analysed.

The grading of the disturbed bulk samples was determined by wet sieving, in accordance with Test 9.2 and 9.3 of BS1377: Part 2, 1990. All peat material was excluded from the sample. The results of the PSD laboratory tests are included in Appendix 5.2.

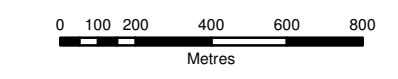
#### *5.3.5 Hydrogeology Data*

##### *Aquifer Classification*

The GSI has prepared a Groundwater Protection Scheme for County Kildare (2004). The aquifer classification for the bedrock units underlying the MBT Facility site are obtained from the GSI website [www.gsi.ie](http://www.gsi.ie) (2012) and an extract from the groundwater web mapping is provided in Figure 5.5 and in Appendix 5.3.



- Legend**
- Site Boundary
  - Landownership Boundary
  - ⊗ Wells
  - Dinantian Lower Impure Limestones
  - Dinantian Pure Bedded Limestones
  - Dinantian Pure Unbedded Limestones
  - Dinantian Upper Impure Limestones



- NOTES**
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A	05-06-12	Issued for Waste License	G.F.	J.D.

Client:  
**BORD NA MÓNA**

Project:  
DREHID  
MECHANICAL BIOLOGICAL  
TREATMENT (MBT) FACILITY

Title:  
SITE INVESTIGATION  
LOCATIONS 2003

Scale @ A3: 1:20,000

Prepared by: G.Fil      Checked: J.Dillon      Date: May 2012  
Project Director: D.Grehan

**TOBIN**  
Patrick J. Tobin & Co Ltd.  
Consulting, Civil and Structural Engineers,  
Block 10-4, Blanchardstown Corporate Park,  
Dublin 15, Ireland.  
tel: +353-(0)1-8030406  
fax: +353-(0)1-8030409  
e-mail: info@tobin.ie  
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**Figure 5.3**      **A**



**GENERAL LEGEND**

OWNERSHIP BOUNDARY — SITE BOUNDARY —

TRIAL PIT LOCATION

BOREHOLE LOCATION

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A	27.06.12	ISSUED FOR WASTE LICENCE	MN	ST

Client:

**BORD NA MÓNA**

Project:

**DREHID  
MECHANICAL BIOLOGICAL  
TREATMENT (MBT) FACILITY**

Title:

**SITE INVESTIGATION  
LOCATIONS 2011**

Scale @ A3: 1:5,000

Prepared by: M. Nolan      Checked: S. Tinnelly      Date: April 2012

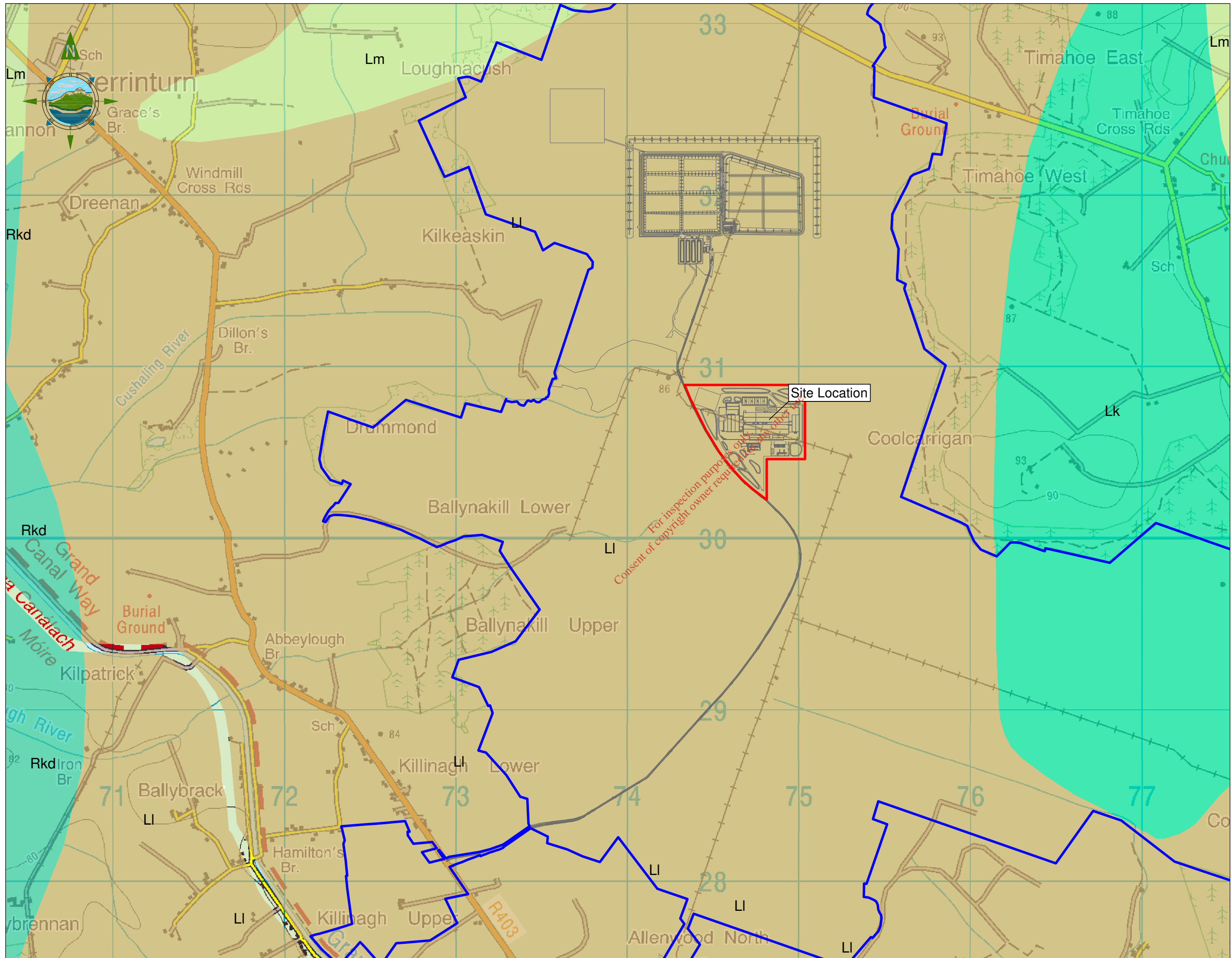
Project Director: D. Grehan

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Patrick J. Tobin & Co. Ltd.

Consulting, Civil and Structural Engineers,  
Block 10-4, Blanchardstown Corporate Park,  
Dublin 15, Ireland.  
tel: +353-(0)1-8030406  
fax: +353-(0)1-8030409  
e-mail: info@tobin.ie  
www.tobin.ie

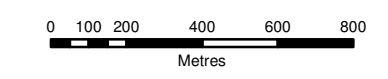
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Drawing No.: **Figure 5.4**      Issue: **A**



**Legend**

- Site Boundary
- Landownership Boundary
- Locally Important Aquifer - Karstified
- Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Regionally Important Aquifer - Karstified (diffuse)



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Client:  
**BORD NA MÓNA**

Project:  
 DREHID  
 MECHANICAL BIOLOGICAL  
 TREATMENT (MBT) FACILITY

Title:  
 AQUIFER  
 CLASSIFICATION MAP

Scale @ A3: 1:20,000

Prepared by: G.Fill      Checked: J.Dillon      Date: May 2012

Project Director: D.Grehan

**TOBIN**  
 Patrick J. Tobin & Co Ltd.  
 Consulting, Civil and Structural Engineers,  
 Block 10-4, Blanchardstown Corporate Park,  
 Dublin 15, Ireland.  
 tel: +353-(0)1-8030406  
 fax: +353-(0)1-8030409  
 e-mail: info@tobin.ie  
 www.tobin.ie

Figure 5.5 A

The Boston Hill Formation and the Waulsortian Limestone Formation are classified as Locally Important Aquifers, which are moderately productive only in localised zones (Ll), see Figure 5.5. The Calp limestone located 2.4 km to the north west of the proposed MBT Facility site is classified as a Locally Important Aquifer generally moderately productive (Lm). The Allenwood Formation and the Ballyadams Formation are located to the east and west of the MBT Facility site. The Ballyadams Formation is located 3.7 km to the west of the MBT Facility site and is classified as a Regionally Important Karst Aquifer (Rkd). The Allenwood Formation located 1.1 km to the east of the MBT Facility site is classified as a Locally Important Karst aquifer (Lk) due to the limited areal extent, while to the west the Allenwood Formation is classified as a Regionally Important Karst Aquifer (Rkd). The variation in aquifer classification is due to the limited areal extent of the Allenwood Formation to the east.

#### *Aquifer Potential*

The groundwater flow characteristics within the limestones underlying the MBT Facility are dominated by secondary permeability, i.e. fissure flow. There is effectively no primary permeability (inter-granular permeability) in these rocks.

As part of previous site investigations of the aquifer potential in 2003, a 72 hour pump test was carried out to determine the characteristics of the aquifer. The pump test was undertaken on borehole GW6, which is approximately 1.5km from the MBT Facility site (Figure 5.3).

The peak pump rate measured during the test was 56m<sup>3</sup>/day. The pump rate of 43m<sup>3</sup>/day was used for calculations as an average pump rate maintained during the log cycle in which the data was interpreted (i.e. 10 to 100 minutes), due to slight fluctuation in discharge during the test.

### 5.3.6 Groundwater Vulnerability

The DoEHLG, EPA and GSI have produced guidelines on groundwater vulnerability mapping that aim to represent the intrinsic geological and hydrogeological characteristics that determine how easily groundwater may be contaminated by human activities. Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability category is based on the relative ease with which infiltrating water and potential contaminants may reach groundwater in a vertical or sub-vertical direction. The permeability and thickness of the subsoil, which influences the attenuation capacity, are important elements in determining the vulnerability of groundwater.

The DoEHLG, EPA and GSI vulnerability mapping guidelines allow for the assignment of vulnerability ratings from “extreme” to “low”, depending upon the subsoil type and thickness. A groundwater vulnerability map for County Kildare has been prepared by the GSI as part of the Groundwater Protection Scheme. According to the information available from the GSI, the vulnerability rating is classified as ‘*Low Vulnerability*’ (>10m, Low permeability soils) across the MBT Facility site, which is the rating that affords greatest natural protection against contamination. Details of vulnerability mapping guidelines are detailed in Figure 5.6 below.

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
<b>Extreme (E)</b>	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
<b>High (H)</b>	> 3.0m	3.0 - 10.0m	3.0 - 5.0m	> 3.0m	N/A
<b>Moderate (M)</b>	N/A	> 10.0m	5.0 - 10.0m	N/A	N/A
<b>Low (L)</b>	N/A	N/A	> 10.0m	N/A	N/A

Notes: (1) N/A = not applicable.  
 (2) Precise permeability values cannot be given at present.  
 (3) Release point of contaminants is assumed to be 1-2 m below ground surface.

**Figure 5-6 Vulnerability Mapping Guidelines**

### 5.3.7 Water Abstractions

During the course of the environmental baseline assessment, information was collated regarding the provision of services to the community surrounding the facility. The MBT Facility is approximately 1.15km from the nearest domestic dwelling (0.94km between the dwelling and the red line activity boundary) and the extremely low permeability and thickness of the soil and subsoil material underlying the MBT Facility site inhibits infiltration to the bedrock aquifer. The water distribution network

from public supplies (Robertstown and Johnstown Bridge) and group water schemes are extensive in this area; however some households may have retained private wells to meet their own water requirements. These supplies will not be impacted by the development as the MBT facility is not located within the respective source protection zones.

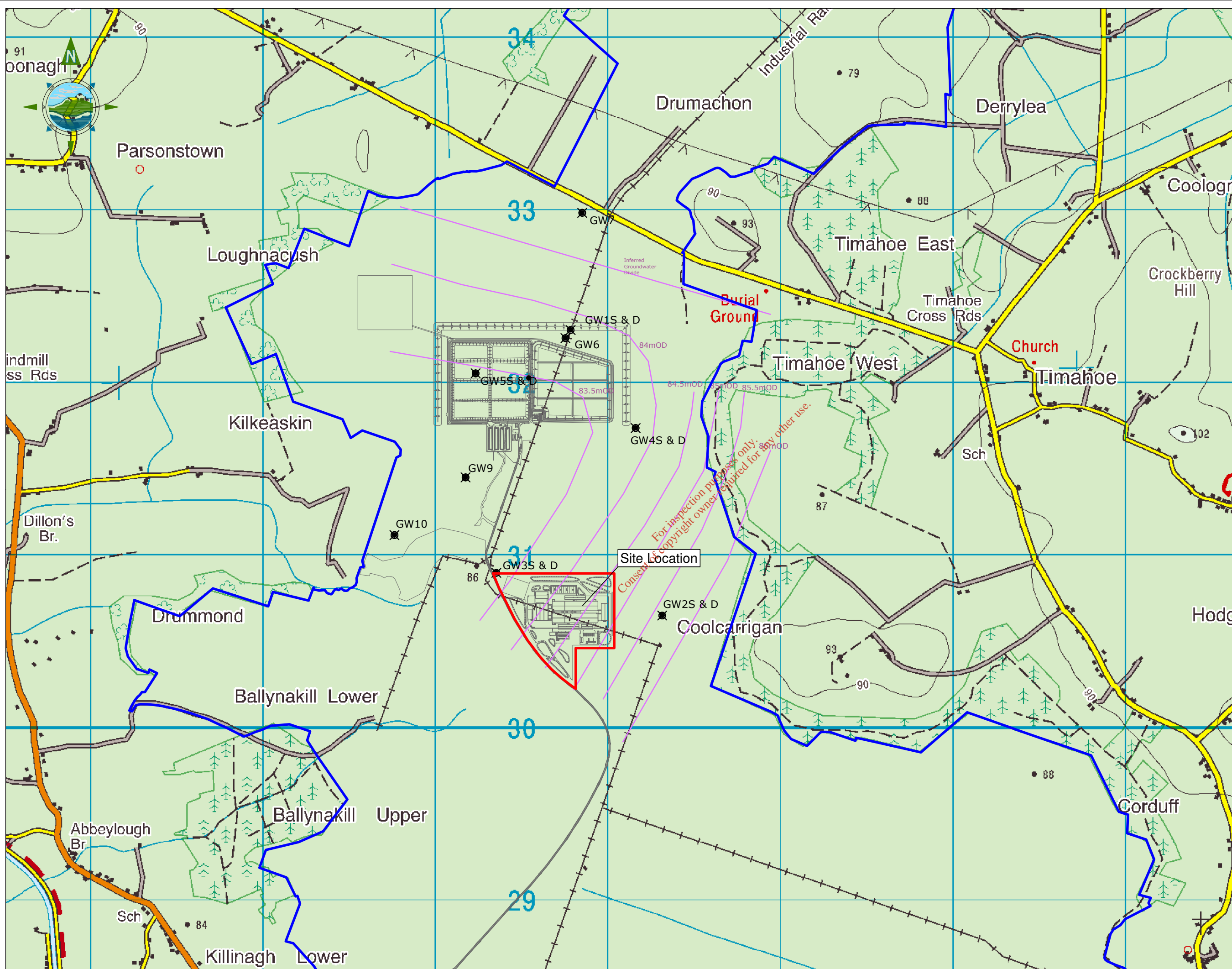
#### 5.3.8 Groundwater Piezometry

Paired monitoring boreholes / piezometers in the bedrock and overburden (See Figure 5.3) were drilled in 2003 at five different locations within the Bord na Móna landholding which provided for monitoring of the shallow and deep groundwater levels. These boreholes are designated a number and the letter “D” if the borehole is screened only in the bedrock (e.g. GW1D); or the letter “S” if it is a shallow overburden borehole screened only in the Till (e.g. GW1S).

In order to determine the groundwater flow direction and the groundwater gradients within the MBT Facility site, the topographic elevation of all monitoring points was established. Based on the water level monitoring and the topographic elevation it was possible to establish the piezometric head at each monitoring point.

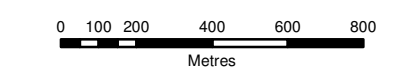
All levels were measured relative to Ordnance Datum (Malin Head). The elevation and piezometric head of all measured points are tabulated in Table 5.1. The piezometric data and inferred groundwater contours are shown on Figure 5.7.

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**Legend**

- Site Boundary
- Landownership Boundary
- Groundwater Contours
- ⊗ Wells



- NOTES**
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
  2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
  3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
  4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
A	05.05.12	Issued for Waste License	G.F.	J.D.

Client:  
**BORD NA MÓNA**

Project:  
 DREHID  
 MECHANICAL BIOLOGICAL  
 TREATMENT (MBT) FACILITY

Title:  
 INFERRED GROUNDWATER  
 CONTOURS

Scale @ A3: 1:20,000

Prepared by: G.Fil      Checked: J.Dillon      Date: May 2012  
 Project Director: D.Grehan

**TOBIN**  
 Patrick J. Tobin & Co Ltd.  
 Consulting, Civil and Structural Engineers,  
 Block 10-4, Blanchardstown Corporate Park,  
 Dublin 15, Ireland.  
 tel: +353-(0)1-8030406  
 fax: +353-(0)1-8030409  
 e-mail: info@tobin.ie  
 www.tobin.ie

Figure 5.7 6301  
A



**Table 5-1 Location and Elevation of Groundwater Monitoring Points and Piezometric Head**

Reference	Grid Reference	Ground Elevation (mOD)	Static Water Level (m OD) Jan 2003	Static Water Level (m OD) Jan 2007	Static Water Level (m OD) Jan 2011
GW1D	E274767, N232294	84.886	83.856	83.922	82.906
GW1S	E274773, N232292	84.852	83.727	84.286	83.582
GW2D	E275305, N230640	87.862	85.857	n/a	n/a
GW2S	E275312, N230650	87.37	86.32	86.07	86.08
GW3D	E274349, N230902	85.115	83.505	82.178	n/a
GW3S	E274354, N230907	85.018	82.998	82.695	82.798
GW4D	E275153, N231756	84.612	83.932	n/a	n/a
GW4S	E275159, N231740	84.213	83.413	n/a	n/a
GW5D	E274236, N232062	85.85	84.895	85.35	83.63
GW5S	E274246, N232059	85.799	85.154	84.919	84.019
GW6	E274765, N232278	84.737	83.782	83.497	n/a
GW 10	E673762, N231115	84.56	n/a	n/a	82.59

It is not possible to accurately tell the natural piezometric level of the bog prior to the drainage and harvesting of peat. Historical data for raised bogs suggests that the water level fluctuation in raised bogs varies by no more than 30cm, which is considerably less than fluctuations that would occur in mineral soil/subsoil and exposed bedrock environments.

The shallow subsoil piezometric levels and the deep bedrock piezometric levels differ across the MBT Facility site. The shallow piezometric levels are considered to be

heavily influenced by the artificial drains traversing the MBT Facility site. These drains are excavated to the level of the mineral subsoil across the MBT Facility site. Shallow flows are considered to discharge to the drains, with very short flowpaths. The fluctuation in water levels varies in response to rainfall in the shallow subsoil environment.

The bedrock piezometry is not considered to be as heavily influenced by the artificial drainage of the MBT Facility compared to the shallow piezometers. The bedrock piezometric levels suggest that the groundwater flow is from the east towards the west of the MBT Facility site (see Figure 5.7). The flow direction is consistent with the surface water drainage from the MBT Facility, which is towards the west/southwest and the Cushaling River and the Abbeylough River. The Cushaling emerges as a surface flow within the Bord na Mona landholding and continues to flow and gain groundwater baseflow further to the west of the property.

## 5.4 POTENTIAL IMPACTS

### 5.4.1 Potential Impact of Configuration A (MBT with Composting)

#### **Construction Phase**

Potential impacts during the construction phase include activities associated with the movement, excavation and disposal of soils, contaminated materials (if present), compaction of soils and construction of roads. This can result in temporary and permanent impacts on the geological environment.

In order to minimise any potential impact on the environment, including the soil, geological and hydrogeological environment, 'Avoidance of Impact' was incorporated into the design of the development. For example, one of the considerations when selecting the site within the Bord na Móna landholding was minimising the depth of peat that would require excavation.

Some shallow peat removal along the proposed access roads and hardstand areas will be required. However, the natural soil and geological environment has been impacted by past industrial activity undertaken within the proposed property. Since the cessation of peat harvesting the lands have largely remained unaffected by human activity or development. The proposed facility involves the development of approximately 29ha of land within an overall landholding of 2,544ha. The geological and hydrogeological environment over a large area within the landownership boundary (2,544 ha) will therefore remain unaffected by proposed activities.

Earthworks and excavations are likely to cause the greatest impact on the soil environment during the construction phase. Imported material required for the construction of the facility will require appropriate handling during the construction

phase. There is potential to encounter contamination in the former railway line during construction works. Proposed mitigation measures are included in Section 5.5.

All excavations within the MBT Facility site will be terminated in the unconsolidated material with the exception of driven piles which may be required during the construction phase; potential impact on the bedrock environment will be negligible. It will be necessary to progressively clear the peat material from the proposed footprint in order to achieve formation levels for proposed construction. Approximately 66,000 m<sup>3</sup> of peat and subsoil will be removed to allow construction of the hardstand areas, settlement lagoons and roads. The peat and subsoil material will be used to screen the proposed facility as outlined in section 10 of the EIS.

The operation of plant and machinery during construction poses a potential risk of soil and groundwater contamination, through the potential spillage of fuel, lubricants or chemicals directly onto exposed surfaces.

The potential impact associated with exposed soil surface principally relates to sediment laden run-off to watercourses. The greatest risk of sediment run-off will occur during wet weather. Management and control of water falling on worked areas will be an important aspect in minimising the impact of construction. Mitigation measures are proposed below in Section 5.5 to reduce the impact on the soil environment. The implementation of such measures will ensure that surface water discharges will be of good quality.

The baseline assessment indicates that there are no groundwater abstraction wells for potable supply within approximately 1km of the proposed MBT Facility (based on distance to nearest sensitive receptors). Due to the low permeability of the natural subsoil and the thickness of this unconsolidated material, the potential impacts on any domestic wells or boreholes in the broad vicinity of the proposed facility are considered low. Based on hydrogeological conditions in this region the zone of contribution to domestic wells is small and would not extend to the MBT Facility.

The proposed facility will not impact upon the quality or abstraction rate of any supplies in the area. The proposed facility is outside of the source protection zones of both the Robertstown well field and the Johnstown Bridge well field (over 5 km from the MBT Facility). Therefore the proposed MBT Facility will not impact upon these abstractions.

### **Operational Phase**

Due to the nature of the proposed development, machinery will be present and operational on the MBT Facility. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause contamination if the contaminants entered the soil environment. Similarly there is the potential for leakage

of process water from the proposed MBT Facility which could cause contamination of the soil and groundwater environment.

However, given that the MBT Facility site is underlain with low permeability subsoil, the potential for migration offsite is low/negligible. Contaminated groundwater/soil would be contained in the shallow subsoil environment and treated in accordance with mitigation measures outlined below.

As the greatest potential impact will be as a result of processes associated with the operation of the MBT Facility and potential spillages that may directly or indirectly impact on the surface water environment in the area of the development, operational impacts are considered in more detail in Chapter 6, Water.

#### *5.4.2 Potential Impacts of Configuration B (MBT with Dry Anaerobic Digestion and Composting)*

The potential impacts for Configuration B (MBT with Dry Anaerobic Digestion and Composting) are similar to the potential impacts for Configuration A (MBT with Composting) and therefore the potential impacts are as outlined above in section 5.4.1.

### 5.5 MITIGATION MEASURES

#### *5.5.1 Mitigation Measures for Configuration A (MBT with Composting)*

##### **Construction Phase**

The mitigation measures proposed herein are to ensure that the proposed development has a minimal impact on the soil, geology and hydrogeology environment. As detailed above, during the development design, “Avoidance of Impact” was incorporated into the design rationale, to ensure that, insofar as possible, potential impacts were eliminated and mitigation measures were incorporated to minimise the risk to the environment.

All potentially polluting materials, including hydraulic fluid, engine oil and fuel, will be stored in specified areas, which will be bunded to ensure total containment in the unlikely event of total failure of a storage tank. This will reduce the risk of soil contamination due to activity of plant and equipment. There is potential to encounter contamination in the former railway line during construction works. Any potential contamination will be sampled according to best practice and removed to an appropriate licensed waste facility in accordance with the Waste Management Act 1996-2011.

During the construction of the facility and especially when excavation of unconsolidated material is required, standard approved working methods will be employed to reduce the risk to the surrounding environment. Exposed soil surfaces have the potential to flow from the MBT Facility site to surface water channels. Temporary and permanent water control measures, comprising temporary sediment control measures and permanent settlement lagoons, will control the quality of any water discharged from the site of the MBT Facility. Details of the water control measures are included in the Water Chapter, Section 6.

During the course of progressive ground clearance for the proposed facility footprint, the excess soil material will be used to create visual berms where possible. To mitigate soil erosion, all exposed soil surface will be anchored by vegetation and/or by use of ground stabilisation geogrids. During construction work and until vegetation has anchored the embankments, any water accumulating on exposed soil will be diverted through settlement lagoons.

The use of piled foundations for the MBT building will minimise the requirement for subsoil and peat removal from large areas of the MBT Facility. Due to the minimal disturbance of the geological environment, the mitigation measures are restricted to the stabilisation of exposed soil surfaces.

The surface water run-off from low risk hardstanding areas will be collected centrally, where the accumulated water will be diverted through a sediment grit trap, an oil interceptor and finally discharged to the proposed facility surface water lagoons. A fixed rate outfall will be maintained from the surface water retention lagoons to the adjoining drainage network, which drains to the Cushaling River via the existing Bord na Móna surface water lagoon which services the southern portion of the Bord na Móna landholding. The fixed rate outfall from the Facility surface water retention lagoons will ensure that during extreme rainfall events peak flows will be retained within the MBT Facility site, as described in detail in Chapter 6 of this EIS.

In order to provide assurance that the MBT Facility is constructed in accordance with intended design and technical specifications, a comprehensive Construction Quality Assurance (CQA) plan will be implemented during the construction stage. A Construction Quality Assurance (CQA) validation report will be completed for the MBT Facility. The validation report will be undertaken by an appropriately qualified independent specialist.

Given the above mitigation measures proposed, it is considered that the impact on the geological and hydrogeological environment will be negligible and permanent.

### **Operational Phase**

The avoidance of impacts is integral to the design and operation of the MBT Facility. The proposed MBT Facility will comprise fully enclosed dedicated buildings for the treatment and processing of waste. These buildings in turn will be fully bunded to prevent leachate and process water from entering the soils and groundwater environment at the proposed MBT Facility.

All potentially polluting materials, including hydraulic fluid, engine oil and fuel, will be stored in bunded areas to ensure total containment in the event of failure of the storage tank/piping. Any vehicles utilised during the operational phase will be regularly maintained and checked to ensure any damages or leakages are corrected. This reduces the risk of soil contamination due to activity of plant and equipment.

If any leakage occurs to the shallow subsoil/groundwater, the potentially polluting material will be contained by the presence of low permeability subsoil material and cannot enter the underlying aquifer. Any contaminated material can be collected and treated in an appropriate manner according to best practice and the waste management act 1996-2011. As part of the operational phase and in compliance with future waste licence conditions, groundwater monitoring will be undertaken at the MBT Facility.

As mentioned in the potential impacts section (Section 5.4), the greatest potential impact during the operational phase will be as a result of processes associated with the operation of the MBT Facility and potential spillages that may directly or indirectly impact on the surface water environment in the area of the development. The mitigation measures associated with these impacts are considered in more detail in Chapter 6 (Water) of this EIS.

Given the above mitigation measures proposed (and the measures included in Chapter 6, Water), it is considered that the impact on the geological and hydrogeological environment will be low/negligible albeit permanent.

#### *5.5.2 Mitigation Measures for Configuration B (MBT with Dry Anaerobic Digestion and Composting)*

The mitigation measures for Configuration B (MBT with Dry Anaerobic Digestion and Composting) are similar to the mitigation measures proposed for Configuration A (MBT with Composting) and therefore the mitigation measures are as outlined in section 5.5.1. above.