



# Bohernabreena Landfill

## Environmental Risk Assessment

November 2019

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# Bohernabreena Landfill

## Environmental Risk Assessment

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## EXECUTIVE SUMMARY

RPS was commissioned by South Dublin County Council (SDCC) to undertake an Environmental Risk Assessment (Tier 1, Tier 2 and Tier 3) of the unlicensed Bohernabreena landfill, located off the Bohernabreena Road, Tallaght, Dublin 24 adjacent to the River Dodder. The landfill site is approximately 2.7 hectares and was used to deposit domestic refuse by Dublin County Council. The landfill was closed in 1974 and is currently unlicensed.

Under current waste regulations the site is classified as an unregulated landfill. The process of applying to the Environmental Protection Agency (EPA) for a Certificate of Authorisation to regularise the site requires the completion of an Environmental Risk Assessment of the site.

This Environmental Risk Assessment has been completed in accordance with the EPA *“Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites”* (April 2007) and is based on the site as it currently exists.

The source of the waste is mixed municipal which extends across the majority of the site. The depth of the waste is very shallow and varies across the site. The landfill is unlined and waste is in direct contact with underlying gravels and clays. The estimated quantity of waste deposited at the site is 151,200 tonnes.

Elevated concentrations of landfill gas (methane and carbon dioxide) were observed across the site with the highest concentrations observed within the centre of the waste body. Low or no flow gas flows observed indicates that the waste is not actively producing gas and the risk from landfill gas is considered low.

No significant volumes of leachate were observed on site, partly due to the dry summer and the lack of a basal liner allowing free drainage of any leachate to the underlying gravels or via direct discharge to the River Dodder. Leachate contained exceedances of statutory limits for levels of Iron, Manganese, Ammoniacal Nitrogen, microbial indicators and Benzene.

The groundwater levels across the site are high and in contact with the gravel layer and overlying waste. Groundwater monitoring wells indicated exceedances of levels Arsenic, Manganese and Chloride. Water seepages on the site which emerged along the River Dodder bank indicated exceedances of Ammonia and Arsenic suggesting leachate breakout

Surface water samples taken from the adjoining Friarstown Landfill leachate overflow pipe indicate very high levels of Ammoniacal Nitrogen impacting the River Dodder.

Based on the methodology of the EPA *“Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites”* (April 2007) the site is considered as **Low Risk (Class C)**, however, there is evidence that the site is having a direct adverse impact on the River Dodder. Therefore, it is recommended that the remedial measure of installing a capping layer over the waste is completed to mitigate leachate generation and subsequent impact.

It is also recommended that the Friarstown landfill overflow pipe is removed from flowing into the River Dodder.

# 1 INTRODUCTION

RPS was commissioned by South Dublin County Council (SDCC) to undertake an Environmental Risk Assessment (Tier 1, Tier 2 and Tier 3) at the unlicensed Bohernabreena landfill, located off the Bohernabreena Road, Tallaght, County Dublin (refer **Figure 1.1**). The landfill site is approximately 2.7 hectares and was used to deposit domestic refuse by Dublin County Council until the landfill was closed in 1974. The landfill site is currently unlicensed and used for agricultural purposes.

Under the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008, S.I No. 524 of 2008 an application to the Environmental Protection Agency (EPA) for a Certificate of Authorisation must be made to regularise the site. The application for a Certificate can only be made by Local Authorities (i.e. SDCC) and must be supported by an Environmental Risk Assessment carried out in accordance with the “Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites” EPA 2007 (EPA CoP).

## 1.1 OBJECTIVE

The overall objective of this Environmental Risk Assessment is to identify any environmental or human risks resulting from the landfill site in its present condition in accordance with the EPA CoP. Specific objectives include:

- Determination of the nature and extent of the waste mass at the landfill;
- Provision of information to assess the significance of active pollutant (Source-Pathway-Receptor) linkages present at the landfill site;
- Provision of a detailed Conceptual Site Model for the landfill site;
- Final classification of the risk status of the site; and
- Provision of remedial strategy (if required).

## 1.2 SCOPE OF WORK

In order to achieve the above objectives, the following scope of work was completed:

- Tier I Preliminary Site Investigation comprising a desk based study and site inspection to develop an initial CSM;
- Tier II Exploratory and Main Site Investigation comprising an intrusive site investigation to provide information to assess significant pollutant risk linkages; and
- Tier III Refinement of CSM and Quantitative Risk Assessment, outlining conclusions and recommendations.

The Environmental Risk Assessment was written in accordance with the following guidance;

- EPA 2003, Landfill Manuals: Landfill monitoring (2nd Edition)
- EPA 1999, Landfill Manuals: Site Investigations

- CLR Report No. 4 1994 – Sampling Strategies for Contaminated Land, DoE, Contaminated Land Research (CLR) Report
- BS 5930: 1999, Code of Practice for Site Investigations
- BS 10175: 2000, Investigation of Potentially Contaminated Sites – Code of Practice
- EPA landfill Restoration and aftercare manual

### 1.3 LIMITATIONS

The following notes should be read in conjunction with this report:

1. This report contains only the available factual data for the site obtained from the sources described in the text.
2. The review of the site is based on documentation and information provided by SDCC.
3. Where data have been supplied by the client or other sources, it has been assumed that the information is correct but no warranty is given to that effect. While reasonable skill and care has been applied in review of this data no responsibility can be accepted by RPS for inaccuracies in the data supplied.
4. During the site works, accessibility to the entire site was constrained by the steep river bank at the western boundary of the site. Areas where the Health and Safety of RPS personnel would have been compromised were not accessed.

The conclusions presented in this report represent RPS' best professional judgement based on review of site conditions observed during the site visit and the relevant information available at the time of writing. The opinions and conclusions presented are valid only to the extent that the information provided was accurate and complete.


### 1.4 REPORT FORMAT

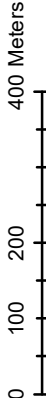
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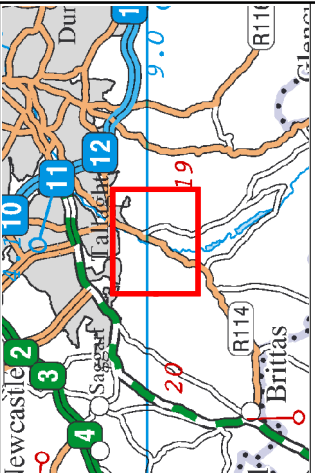
- Section 1: Introduction
- Section 2: Tier I - Preliminary Investigation and Risk Screening
- Section 3: Tier II - Site Investigation and Testing
- Section 4: Tier III - Refinement of CSM and Quantitative Risk Assessment
- Section 5: Conclusions and Recommendations

### Legend

Site Boundary







**Client**

Comhairle Contae  
Atha Cliath Theas  
South Dublin County Council

**Project**

Bohernabreena Landfill  
Environmental Risk Assessment

**Title**

Figure: 1.1

**Site Location**

West Pier Business Campus,  
Dun Laoghaire,  
Co. Dublin,  
Ireland.  
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E: ireland@rpsgroup.com  
W: rpsgroup.com/ireland

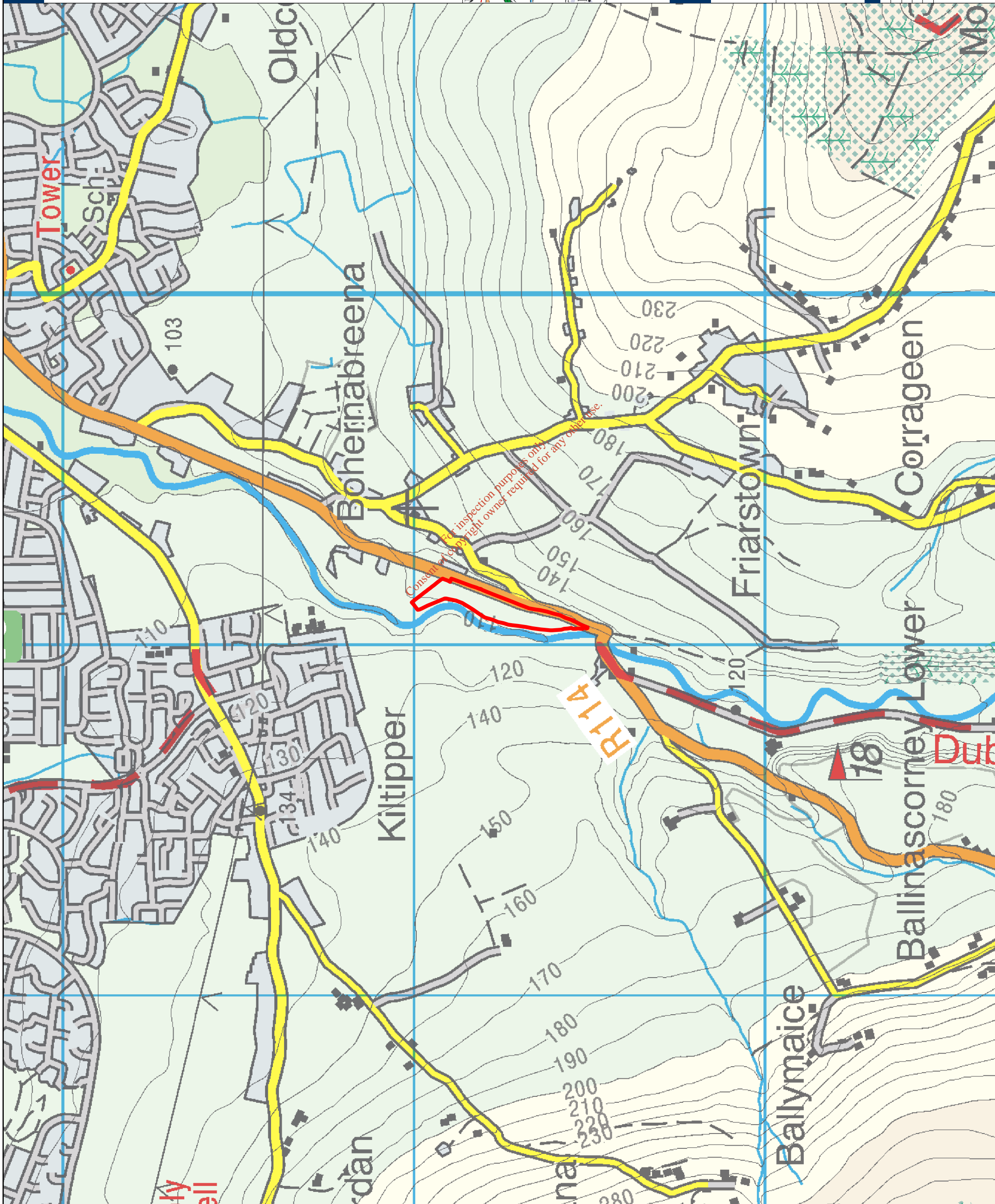
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## 1.5 RISK ASSESSMENT APPROACH

This Environmental Risk Assessment has been carried out in accordance with the “Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites” EPA 2007 (EPA CoP). The consideration of the impact of the historical landfill site may have on the environment and human health is based on a risk assessment of active pollutant ‘Source–Pathway–Receptor (SPR)’ linkages defined from the Conceptual Site Model (CSM), where the probability of impact by the landfill site is considered in the context of the severity of consequence of that event actually happening. The pollutant (SPR) linkage approach underpins the EPA CoP.

The assessment looks at the relationship of possible contamination of the environment (i.e. the surroundings and habitats) and of a range of receptors (such as humans, flora, fauna, groundwater and ecological systems) to develop a conceptual understanding of what is occurring. Aspects of the source material and impacts on the receptors are identified and measured as part of a characterisation process. This in turn facilitates the development of environmental engineering design controls to manage, mitigate, protect, and/or remediate the site.

The principal sources of contamination from landfilled waste are liquid leachate and landfill gas generated through the decomposition of the waste mass. The type of waste is characterised in order to determine the potential magnitude of risk posed to surface water and groundwater receptors.

An assessment of the potential for landfill gas generation as a contaminant source is also a requirement and its rate of gas generation and potential for migration needs to be considered.

The relationship between the discrete **source** of the contamination (i.e. waste material) and the receiving environment known as the **receptor** (e.g. surface water, groundwater or humans) is considered. The connecting route, known as the **pathway** (e.g. groundwater flow, drainage systems, soil systems, air movements) and the driving force in the form of a fluid (i.e. liquid in the form of rainfall and leachate, gas from landfill gases) can induce contamination to move through the system. Thus, the system can be summarised by the following Source Pathway Receptor model:

- **Source:** Substance or material that has the potential to cause harm to the environment or human health by virtue of its physical or chemical characteristics.
- **Pathway:** Historical, current or possible future mechanism by which the receptor can be exposed to the source.
- **Receptor:** A human or environmental entity which has the potential to be harmed through direct or indirect exposure to the source.

In the pollutant linkage approach to risk assessment (i.e. SPR), all three elements have to be present and linked in order for a risk to be present. If any of these components is absent there is, by definition, no risk. The EPA CoP utilises a structured phased approach to identify the SPR components and conduct a risk assessment of the linkages between the elements. The process involves preliminary site investigations and initial screening to indicate the range of high to low risk factors. Areas requiring further investigation are identified, and finally the CSM is refined. At each stage the information and risks are reviewed and assessed before progressing to the next phase.

Assumptions and uncertainties in the development of a CSM must be identified and clearly expressed to ensure that the degree of representation is understood before evaluation can meaningfully take

place. The tiered technique of risk assessment within the CoP seeks to minimise gaps in characterising each of the components within the SPR framework, so that at each tier the conceptual model is refined and uncertainties are reduced. Accordingly, the extent of information and data available at each tier of the model development is incorporated within each individual section of the assessment for individual tiers.

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## 2 TIER I PRELIMINARY RISK ASSESSMENT

This section presents the Tier I Conceptual Site Model (CSM), Risk Screening and Prioritisation.

### 2.1 PROJECT OBJECTIVE

The objective of the Tier I assessment was to carry out a preliminary site investigation and complete an initial risk and risk prioritisation of the site.

### 2.2 SCOPE OF WORK

For the purpose of this Tier I assessment RPS undertook the following scope of work:

- Desk based study involving a review of public sources of information and available historical information on the site;
- Site walkover survey to inspect the current site conditions and inform the development of the CSM; and
- Risk prioritisation of the site.

The following sources of information were consulted in the compilation of this Tier 1 assessment:

- EPA online datasets;
- Geological Survey of Ireland (GSI) online datasets;
- Aerial Photography;
- National Parks and Wildlife Service (NPWS) online maps and data;
- Eastern Midlands Region Waste Management Plan 2015-2021;
- South Dublin County Council Planning <http://www.sdcc.ie/services/planning>;
- EPA catchments <https://www.catchments.ie/>;
- Review of pertinent environmental historical reports;
- Water Maps interactive tool on the Irish National Water Framework Directive website; and
- Discovery Series Maps (1:50,000) and Orthophotography available from the Ordnance Survey Ireland (OSI).

### 2.3 BACKGROUND

#### 2.3.1 Site History

There is limited public information available on the landfill site. Historic maps indicate that there were several gravel pits within the vicinity of the site. Local knowledge indicated that there was a gravel quarry onsite which was active in the 1970s, once gravel extraction had ceased the site was used as a

landfill for domestic refuse by Dublin County Council and was closed in 1974. There is no information on the volume of waste or type of waste.

### 2.3.2 Existing Landfill Policy

The waste management plans, including the Eastern Midlands Region Waste Management Plan 2015-2021 (Dublin City Council, 2015), have recognised the need to address legacy and historic unregulated landfills within their respective regions. Policy G2 of the Plan states:

*Roll-out the plan for remediating historic closed landfills prioritising actions to those sites which are the highest risk to the environment and human health.*

This policy has been agreed by the relevant Local Authorities and discussed at Departmental level. In order to prioritise the high risk sites the plan programme proposes to complete the investigation, authorisation and remediation of the remaining Class A sites in accordance with the following priority order:

1. Sites with a gas source-pathway-receptor linkage containing hazardous waste;
2. Sites with a gas source-pathway-receptor linkage;
3. Sites with a groundwater vulnerability source-pathway-receptor linkage, and
4. Sites with a surface water vulnerability source-pathway-receptor linkage.

From a review of the register compiled in accordance with the Waste Management Act 1996 as amended (the Act) and presented in the Eastern Midlands Region Waste Management Plan 2015-2021, the site was previously classified as a Class C (Low Risk) site as noted in **Table 2.1**.

**Table 2.1 Previous Risk Rating of the Site**

Site ID	Local Authority	Site Name	Risk Rating
S22-02632	South Dublin County Council	Bohernabreena Ref B 215	Class C (Low Risk)

Source: Eastern Midlands Region Waste Management Plan 2015-2021

Section 22 of the EPA Register of historic landfill sites classifies the site as “pre 1977”. The EPA CoP does not specially address these sites as these were in existence before the relevant legislation and historically considered low risk due to the age of waste and likely high levels of decomposition that have already taken place. Classifying a site as “pre 1977” affects the landfill score during the risk prioritization.

### 2.3.3 Planning

According to the SDCC planning website (SDCC, 2018) there have been no planning applications on the site.

### 2.3.4 Previous Environmental Investigations

There have been no previous site investigations completed at the site. In 2014, members of the public reported to SDCC incidents of leachate staining along the Dodder river bank of the site. SDCC

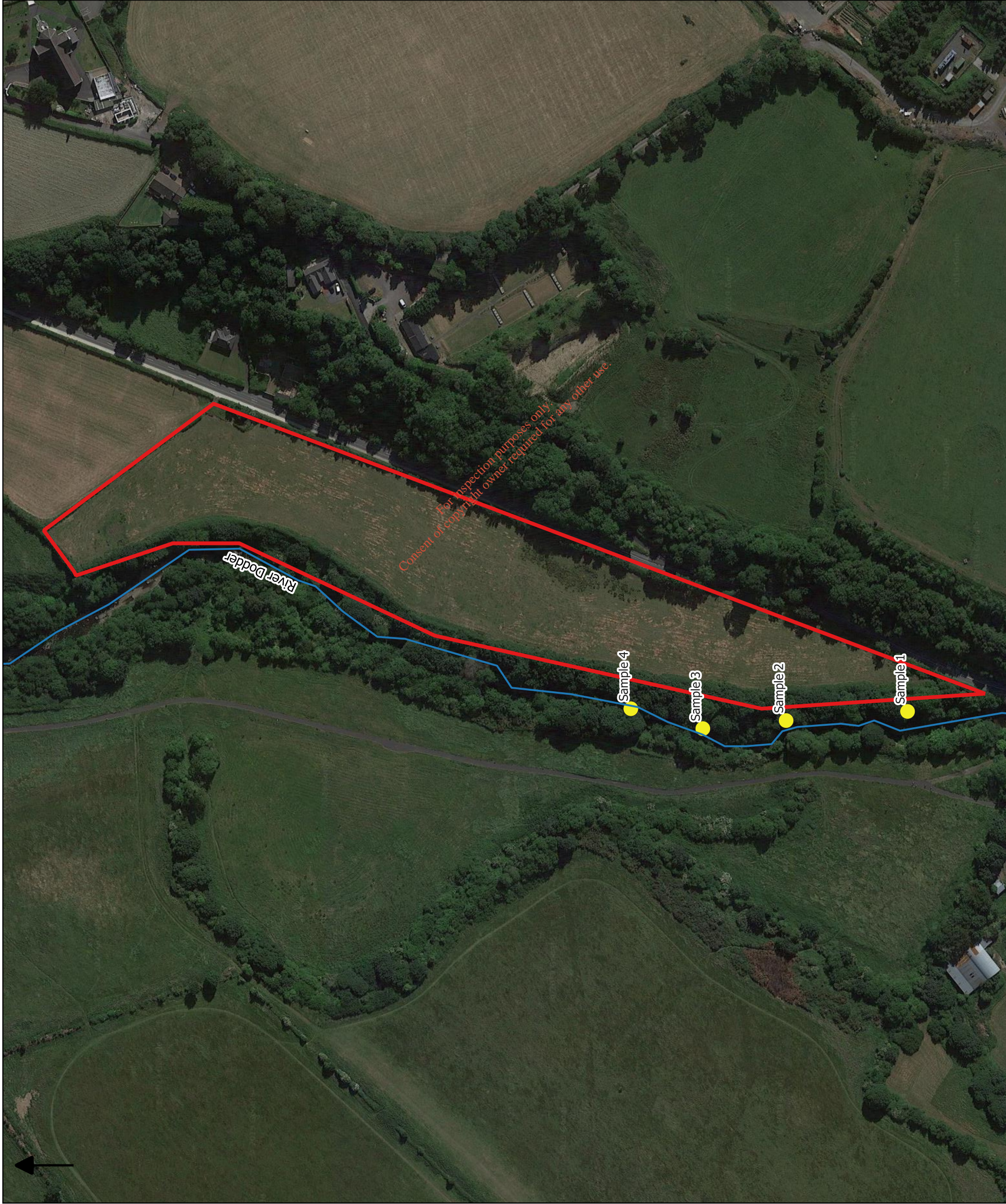


subsequently sampled leachate at 4 No. locations along the Dodder river bank (**Figure 2.1**). The results are included in **Appendix A** and summarised in **Table 2.2** and indicate an exceedance of relevant statutory limits for Ammoniacal Nitrogen and Biological Oxygen Demand (BOD).

**Table 2.2 River Dodder Leachate Monitoring Results 2014**

Parameter	Surface Water Regulations (2009 and 2015)	Location			
		Sample 1: 500mm Culvert discharge TRHB to Dodder 100m D/S Fort Bridge	Sample 2: 170m D/S Fort Br. seepage study in Rock Pool TRHB	Sample 3: 210m D/S Fort Br. seepage from TRHB (leachate smell)	Sample 4: 250m D/S Fort Br. seepage from TRHB (Leachate smell)
pH	6.0 - 9.0	7.8	6.8	7.1	7.1
Electrical Conductivity	1875	1414	1012	570	1130
Total Suspended Solids		12	16	19	59
BOD	1.5	2	2	<1	3
COD		37	11	<10	33
Total Oxidised Nitrogen as N		4.15	0.21	<0.09	<0.09
Ammoniacal Nitrogen as N	0.065	64.55	15.44	4.38	34.38
Nitrate		4.04	0.2	<0.09	<0.09
Nitrite		0.11	0.012	<0.005	<0.005
Phosphorus (React)		<0.03	<0.03	<0.03	<0.03

Grey shading indicates an exceedance.

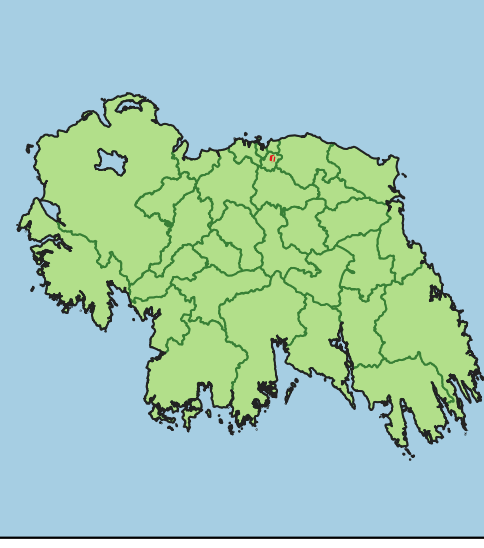


**Legend**

- River Dodder
- Site Boundary
- Sea\_Background
- County Boundary\_NoDetails
- Sample Leachate Location

**Google Map**

Identifying leachate sample locations of previous investigation.



**Title: Figure 2.1 SDCC Leachate Sampling**

**Project:** Bohernabreena

**Client:** South Dublin County Council

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Approved by: xxx	Drawing No.: QGIS0001
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Date: 21/06/2019	

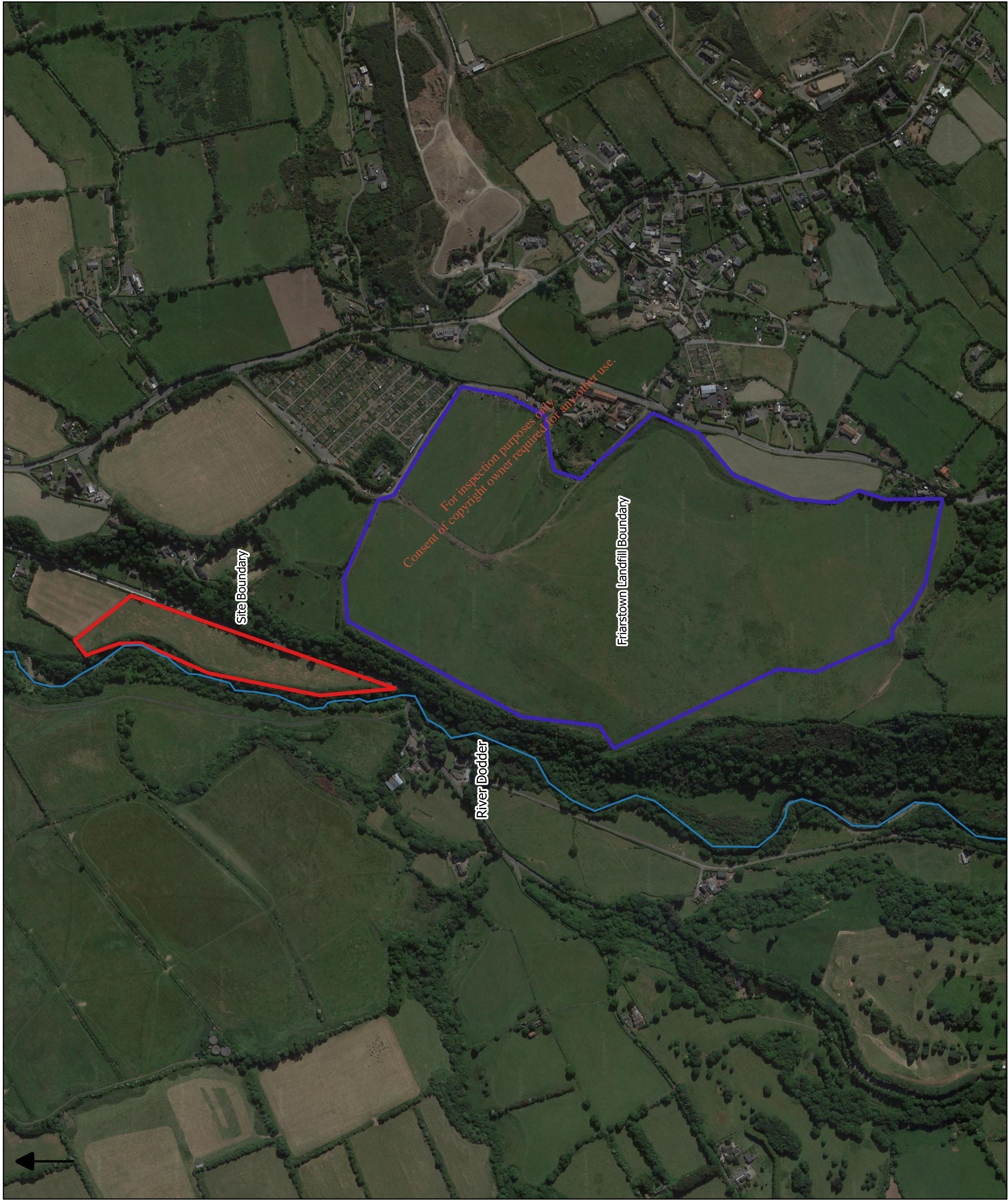
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### 2.3.4.1 Adjacent Landfills

Friarstown landfill is located adjacent to the southern boundary of the landfill site (refer **Figure 2.2**). The Friarstown landfill is classified as a Class A (High Risk) (Site ID S22-02166) according to the Eastern Midlands Region Waste Management Plan 2015-2021. The Friarstown landfill is a former waste disposal site operated by SDCC (former Council landfill) for 22 years which was closed in 1997 and capped in 2003. Currently there is onsite emission monitoring and a weather station. The landfill has been used for energy recovery and electricity generation since its closure. An Environmental Risk Assessment had not been completed at the Friarstown landfill, however environmental monitoring has been completed at this site on surface water, groundwater and gas (reports available are included in **Appendix B**). No groundwater wells are located directly downgradient of the landfill. Leachate tanks for the Friarstown landfill are located opposite and the Bohernabreena Landfill site and are monitored regularly by SDCC (available data is attached in **Appendix B**). The Friarstown landfill leachate overflow pipes run across the Bohernabreena landfill site and discharges into the river Dodder along the boundary of the Bohernabreena Landfill site. At the time of the Tier I investigation, leachate was flowing out of the pipe. **Plate 2.1** and **Plate 2-2** show the leachate tanks and the overflow pipe discharging into the River Dodder.

Adjacent to the northern boundary of the Bohernabreena landfill site is an additional landfill, also named the Bohernabreena landfill S22-02767 - Bohernabreena Ref B 216 Class C (Low Risk). There is no information available on this site and it is not mapped in **Figure 2.2**.

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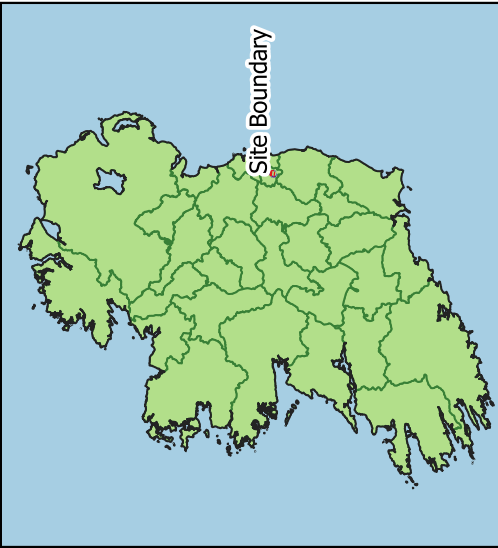


### Legend

	River Dodder
	Site Boundary
	Friarstown Landfill
	Sea_Background
	County Boundary_NoDetails

**Google Map**

Map shows the 2 No. adjacent landfills in the Bohernabreena area.



Title: **Figure 2.2 Adjacent Landfills**

Project: Bohernabreena Landfill

Client: South Dublin County Council

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Plate 2.1 Friarstown Landfill Leachate Holding Tanks



Plate 2-2 Friarstown leachate tank overflow pipe discharging into the River Dodder

## 2.4 SITE DESCRIPTION

### 2.4.1 Site Setting

The site is located on the Bohernabreena Road, Tallaght, South County Dublin within the townland of Friarstown Upper in a predominantly agricultural area. The site is approximately 2.7 hectares and is used for pastoral grazing.

The site is bounded to the east by the Ballinascorney Road, with the Friarstown Landfill on the opposite side of the road. The River Dodder flows in a northerly directly adjacent to the western boundary, to the south is the Font Bridge. Directly north of the site is the Bohernabreena landfill (Ref B 216) this land is currently used for agricultural purposes.

#### 2.4.1.1 Regional Topography

The site is located within a river valley with the Dodder terraces either side of the river valley. The site rises from 111mAOD at the north of the site to 118mAOD at the southern boundary. To the eastern boundary there is a steep slope to the River Dodder level (approximately 100mAOD).

#### 2.4.1.2 Walkover Survey

RPS completed a site walkover survey of the site and surrounding area on the 11<sup>th</sup> September 2018 and a walkover survey checklist was prepared (EPA Code of Practice - Environmental Risk Assessment for Unregulated Waste Disposal Sites, 2007).

No visual or olfactory evidence of contamination was noted during the site walkover. The site is used as pastoral lands for livestock. No perched water was observed, however there was evidence of water logged with sunken marshy areas with rushes.

## 2.4.2 Geology

### 2.4.2.1 Soils and Subsoils

According to the GSI, the soils beneath the site area are classified as Alluvium undifferentiated. The area immediately surrounding the river alluvium consists predominantly of coarse loamy drift with siliceous stones (**Figure 2.3**).

The subsoils beneath the site area are classified as Alluvium (Carboniferous Limestone sands and gravels) and tills derived from Lower Palaeozoic sandstones and shales (TLPSS) in the immediate surrounding area (**Figure 2.4**).

The GSI Geotechnical data viewer shows a number of trial pit entries for a site approximately 150 metres east of the site (ID: 4133). The trial pits indicate layers of silty and sandy clays and sandy gravels in the top three metres.

### 2.4.2.2 Bedrock Geology


According to the GSI, the entire site is underlain by the Aghfarrell Formation which consists of thinly-bedded greywacke siltstone, slate and quartzite deposited by turbidity currents in the Palaeozoic (**Figure 2.5**). The Lower Paleozoic rocks represent a complex geological history, the rocks are highly folded and faulted representing polyphase deformation. Bedrock permeability is influenced by this deformation.

### 2.4.2.3 Geological Heritage










The site is surrounded to the east and west by the Irish Geological Heritage Site ID: SD004 also known as the Dodder Terraces. The Dodder Terraces comprise a series of flat-topped, elevated terraces above the river and record the deglacial retreat of the ice sheet through South Dublin. The site importance is noted as a location with good potential as a reaching site on glacial meltwater deposition, as the feature is accessible and easily viewed from the R114 at Bohernabreena and the N81 at Templeogue-Tallaght.

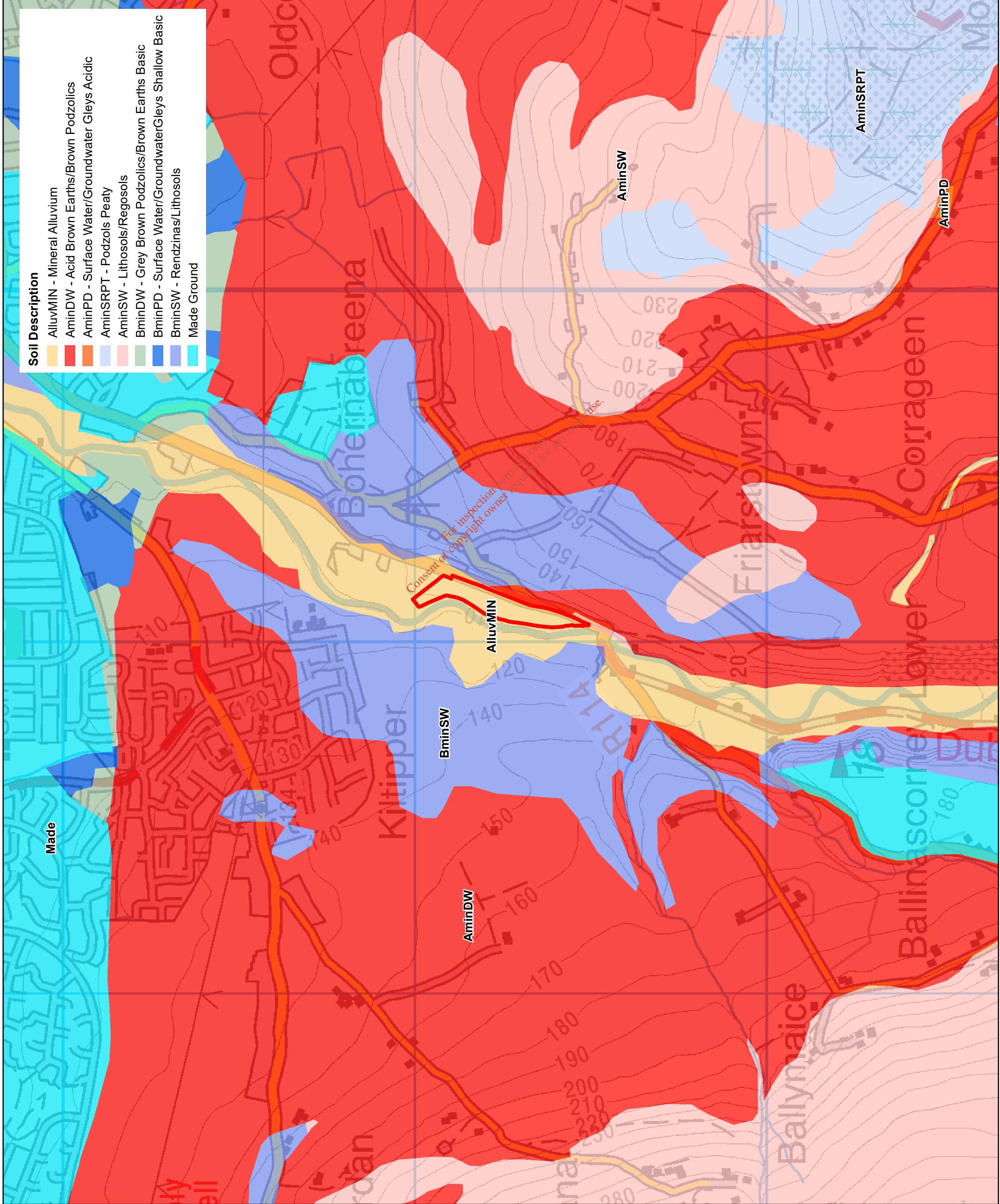
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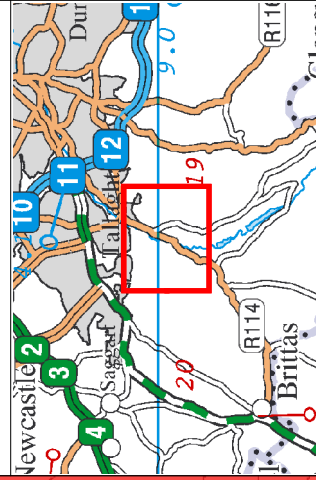
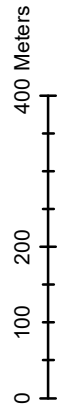
 Site Boundary

## Soil Description

-  AlluvMIN - Mineral Alluvium
-  AminDW - Acid Brown Earths/Brown Podzolics
-  AminPD - Surface Water/Groundwater Gleys Acidic
-  AminSRPT - Podzols Peaty
-  AminSW - Lithosols/Regosols
-  BminDW - Grey Brown Podzolics/Brown Earths Basic
-  BminPD - Surface Water/Groundwater Gleys Shallow Basic
-  BminSW - Rendzinas/Lithosols
-  Made Ground



Data Source: EPA (Soils)



Client

  
 Comhairle Contae  
 Atha Cliath Theas  
 South Dublin County Council

Project **Bohernabreena Landfill**  
 Environmental Risk Assessment

Title **Soils Map of the Site and Surrounding Area**

Figure: 3.1



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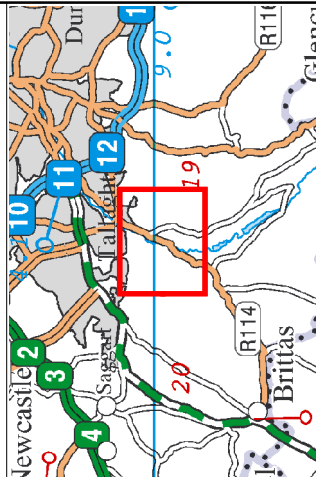
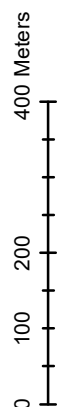
# Legend



Site Boundary



Data Source: EPA (Subsoils)



Client

Comhairle Contae  
Atha Cliath Theas  
South Dublin County Council

Project Bohernabreena Landfill  
Environmental Risk Assessment

Title  
Subsoils Map of the Site  
and Surrounding Area  
Figure: 3.2

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### Subsoil Description

- A - Alluvium undifferentiated
- GLs
- Rck - Bedrock at surface
- TBI
- TLPSSs
- TLs - Limestone till (Carboniferous)
- Made Ground

