

Kildare County Council

Remediation of Legacy Landfill Site at Digby Bridge, Sallins,
Co. Kildare,
Stage 1: Environmental Risk Assessment
and Remediation Plan

Attachment D1- Review of Tier 1 Risk Assessment

May 2020

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**CDM
Smith**

Document Control Sheet

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Abbreviations

BH	Borehole
ca.	Circa / approximately
CoA	Certificate of Authorisation
CoP	EPA Code of Practice in Environmental Risk Assessment for Unregulated Waste Disposal Sites, 2007
CSM	Conceptual Site Model
EPA	Environmental Protection Agency
GSi	Geological Survey of Ireland
GWB	Groundwater Body
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GWS	Group Water Scheme
Ha	Hectares
Lk	Locally Important Karst Aquifer
LI	Locally Important Aquifer
m OD	Metres above Ordnance Datum
OPW	Office of Public Works
OSi	Ordnance Survey of Ireland
NHA	Natural Heritage Area
NPWS	National Parks and Wildlife Service
pNHA	Proposed National Heritage Area
RBD	River Basin District
SAC	Special Areas of Conservation
SI	Site Investigation
SPA	Special Protected Areas
SPR	Source Pathway Receptor
SPZ	Source Protection Zone
SWDTE	Surface Water Dependent Terrestrial Ecosystem
WFD	Water Framework Directive

Section 1 Introduction

1.1 Project Background

Digby Bridge legacy landfill site is located south east of Digby Bridge, in the townland of Barrettstown, less than three kilometres from Sallins as shown in Figure 1.

A Tier 1 Risk Assessment of the site was completed in 2008 by Kildare County Council, in line with the Environmental Protection Agency (EPA) Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites 2007 (CoP). A preliminary Conceptual Site Model (CSM) of the site was developed and the Source-Pathway-Receptor (S-P-R) linkages were evaluated. The Tier 1 categorized the site as being of 'High Risk (Class A)' due to the high risk SPR linkages. The site was entered on Kildare County Council's Waste Management Act Section 22 Register, a list of unregulated waste disposal sites.

Kildare County Council appointed CDM Smith Ireland Ltd (CDM Smith) in 2017 to prepare a Stage 1 Environmental Risk Assessment and Remediation Plan in accordance with the EPA Code of Practice and comprising of Tier 2 and Tier 3 Risk Assessments which will then inform the Remediation Plan. This will provide the basis for the Council's application for a Certificate of Authorisation (CoA) to the EPA as required under S.I. No. 524/2008 - Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008. It will also be required to inform Stage 2 of the Project: Remediation Works.

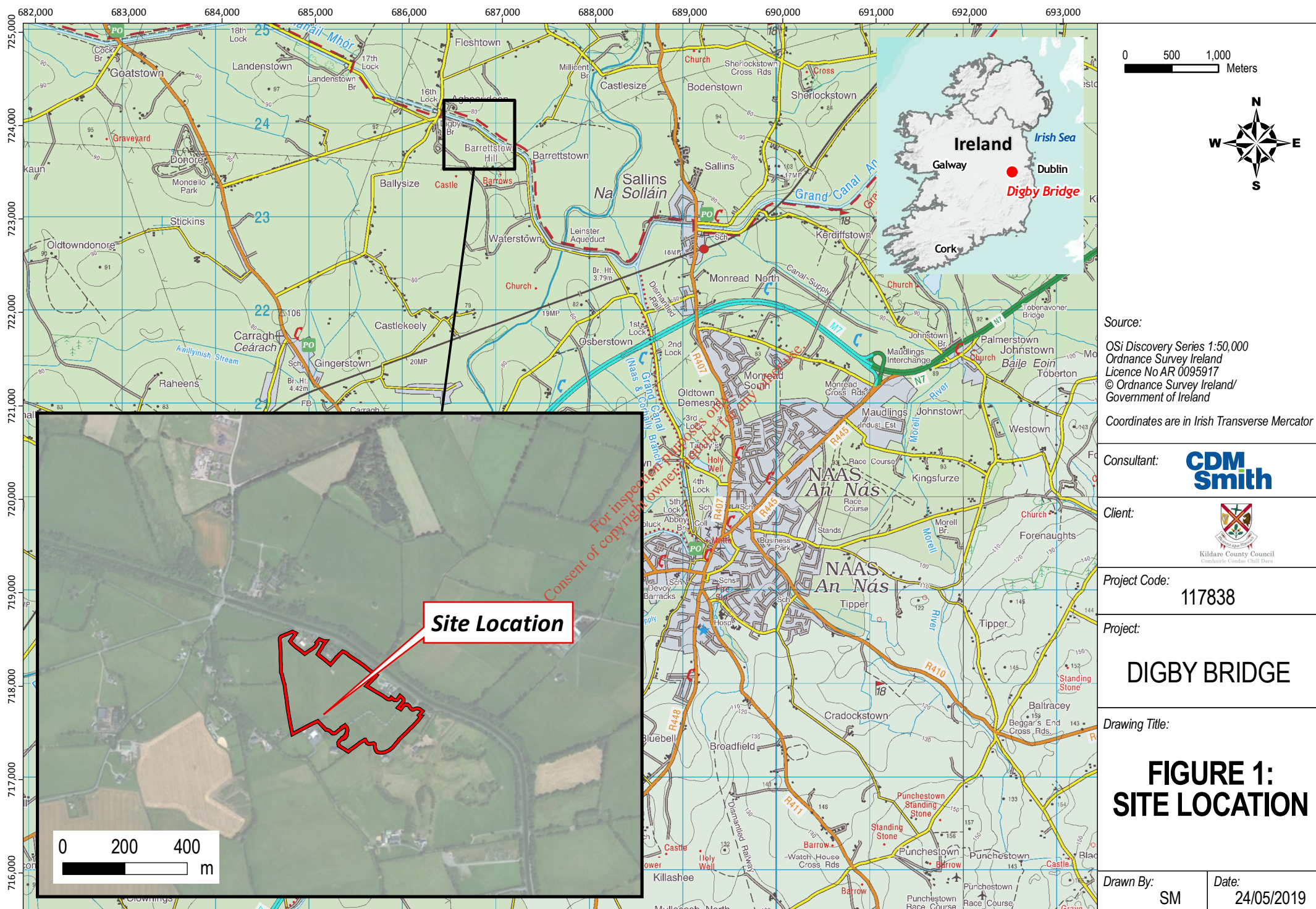
1.2 Purpose of this Report

In accordance with the objectives of the project, as set out in the Project Brief, three number of reports will be prepared

- Tier 2: Site Investigations and Testing;
- Tier 3: Refinement of Conceptual Site Model and Quantitative Risk Assessment;
- Remediation Plan; and
- Appropriate Assessment Screening.

It is also stated that *"The consultant appointed to undertake the Project shall undertake such studies, analyses, assessments, investigations, monitoring and other works as necessary to meet the Project Objectives, in accordance with the EPA Code of Practice."*

This report precedes the Tier 2 Report and reviews background information relevant to the project, including the Tier 1 Risk Assessment of the site completed in 2008 by Kildare County Council. Accordingly, the CSM and S-P-R linkages have been updated where appropriate to inform remainder of the Tier 2 Site Investigation and Tier 3 Quantitative Risk Assessment.



1.3 Information Sources

The principal sources of information and standards used for this study are as follows:

- Kildare County Council Tier 1 assessment and CSM;
- Kildare County Council planning files;
- Section 22 Register;
- EPA, Teagasc and Geological Survey of Ireland (GSI) online databases were reviewed to assess the following:
 - Bedrock type and quaternary geology (soil and subsoil type);
 - Aquifer type;
 - Groundwater bodies;
 - Groundwater vulnerability; and
 - Groundwater and surface water body classification under the Water Frameworks Directive (WFD).
- The National Parks and Wildlife Service (NPWS) online database was reviewed to assess the proximity of the following:
 - Special Protected Areas (SPAs);
 - Special Areas of Conservation (SACs);
 - Natural Heritage Area (NHA); and
 - Proposed NHA (pNHA).
- The Office of Public Works (OPW) online database was reviewed to assess the following Low, Medium and High Probability River Flood Extents in the area;
- The Ordnance Survey of Ireland (OSi) online databases were reviewed to assess the following:
 - Base Information and Mapping;
 - Nature and Environment; and
 - Population and Economy.

Section 2 Environmental Setting

2.1 Description of the Site

The site of the landfill is privately owned and is currently used as horse paddocks and for grazing sheep. While the site footprint covers an estimated 9 Ha, it is believed that only 4 ha may have been landfilled, the site boundary is delineated and shown in Figure 1. The exact footprint of the waste is unknown and will be determined through the Tier 2 investigation. Surrounding lands are mainly used for agricultural activities and there are several residential dwellings close to the site. The Grand Canal runs by the site, just beyond its northern boundary. Table 1 summarises the site and adjacent lands.

Table 1: General Site Information

Detail	Description
Site Name	Digby Bridge Landfill
Site Location	Barrettstown, Co. Kildare
Use	Agriculture; livestock – sheep and horses
Historic Use	Sand and gravel quarry before conversion to municipal landfill
Site Area	ca. 9 Ha
Investigation Area	Across the entire site, adjacent and local properties and the canal
Number of Buildings	0 (14 along site boundary)
Number of Properties	4
North (distance estimated from nearest waste)	Residential dwellings (60m). Local Road (85m). The Grand Canal - pNHA (100m). Agricultural land; livestock – sheep.
South (distance estimated from nearest waste)	Residential dwellings (111m). Agricultural land; livestock – sheep and horses.
East (distance estimated from nearest waste)	Residential dwellings (30m). Agricultural land; livestock – sheep and horses.
West (distance estimated from nearest waste)	Residential dwelling (95m). Agricultural land; livestock – sheep.

2.2 Topography

The approximate elevation of the site is just over 80m above Ordnance Datum (m OD). The site is located on two minor hills located to the south and southwest, the topographical gradient falls in a north-eastward across site towards the canal. A topographical survey will be prepared as part of the Tier 2 Site Investigation.

2.3 Drainage

During periods of heavy rainfall, ponding is evident in some areas of site, this can be seen on natural ground and zones of settlement. There is anecdotal evidence from landowners suggesting that there has been localized flooding in one area of site in the past. A drainage ditch was later constructed to divert this surface water to the road instead of free-flowing into a farm yard. There is no known history of complaints arising from leachate discharge on the road or in the canal.

There is no recorded evidence of wider flooding in the area and there is no national probability status assigned to it on the Office of Public Works national database. The nearby town of Sallins,

three km to the south east, has experienced a recent flooding event resulting from a capacity issue with outfall to the Grand Canal.

2.4 Geology

2.4.1 Quaternary Geology

The GSI Quaternary Geology map shown as Figure 2 indicates that the site is underlain by deposits of gravels derived from limestone. The land north of the site is underlain by alluvium, which follows the course of the Grand Canal, the sequence moving in a northerly direction from the canal is alluvium, gravels and till.

The Teagasc Soils map shown as Figure 3 indicates the quaternary geology of the site is glaciofluvial sand and gravels derived from calcareous materials. The soils are indicated to be shallow and well drained. To the south there is glacial till derived from calcareous parent material.

2.4.2 Bedrock Geology

The GSI Bedrock Geology map (scale 1:100,000) shown as Figure 4 indicates the site is underlain by a massive, unbedded, cherty and often dolomitised limestone of the Rickardstown Formation. This formation is Dinantian (Lower Carboniferous), has also been described as a pure bedded limestone and is thought to be more than 100m thick. The formation is mostly surrounded by the Waulsortian limestones. The Waulsortian Limestones are massive, unbedded/crudely bedded lime-mudstones. They are of older Dinantian age and are typically 300m to 500m thick.

Based on the same map, there have been two outcrops identified less than 500m north of site and structural measurements have been made in the past. The bedding is stratigraphically up (right-way-up), striking 359.71° and dipping 30° W. There are two bounding faults located to the north and south of the formation in this area, trending northwest-southeast.

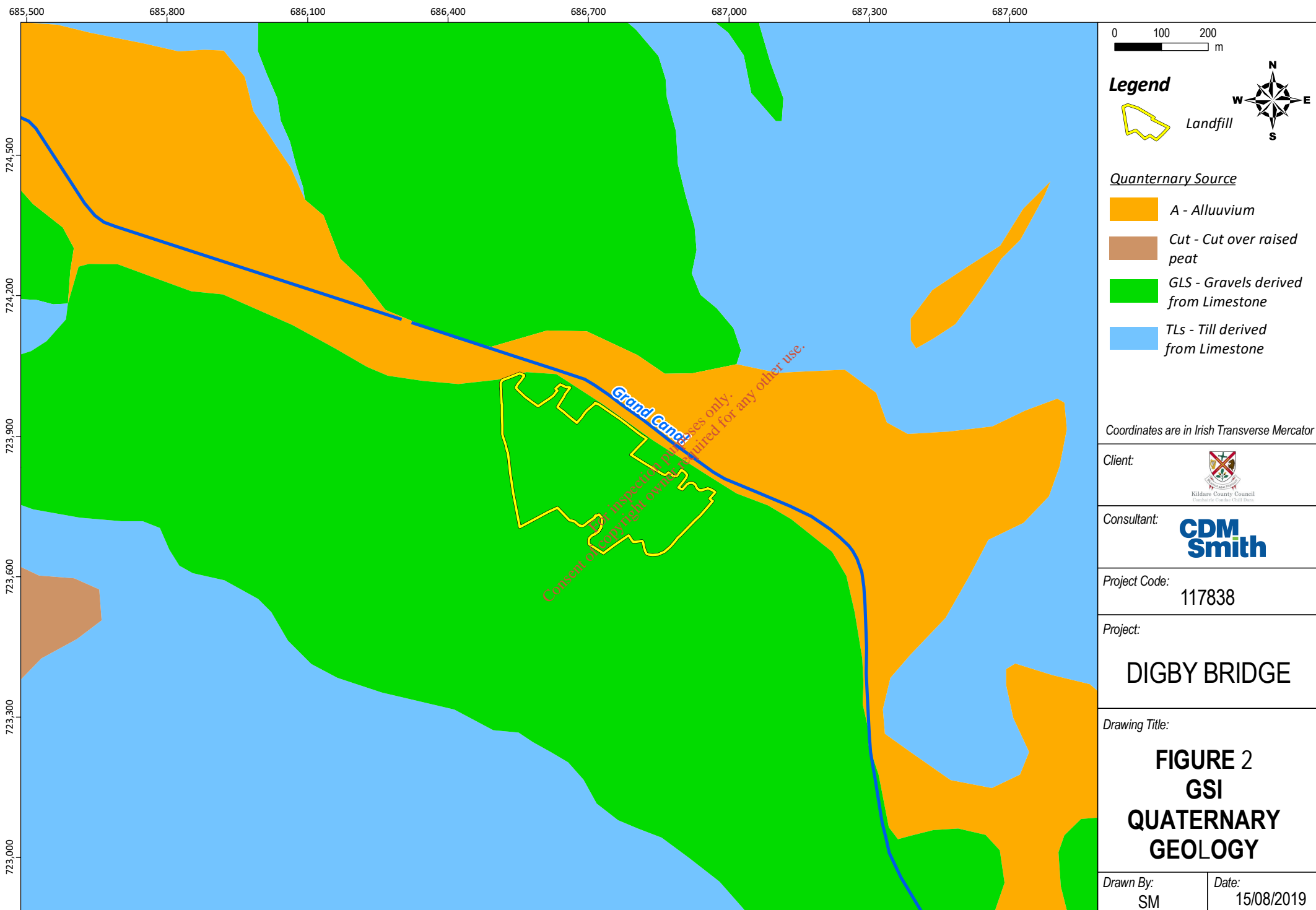
2.4.3 Karst

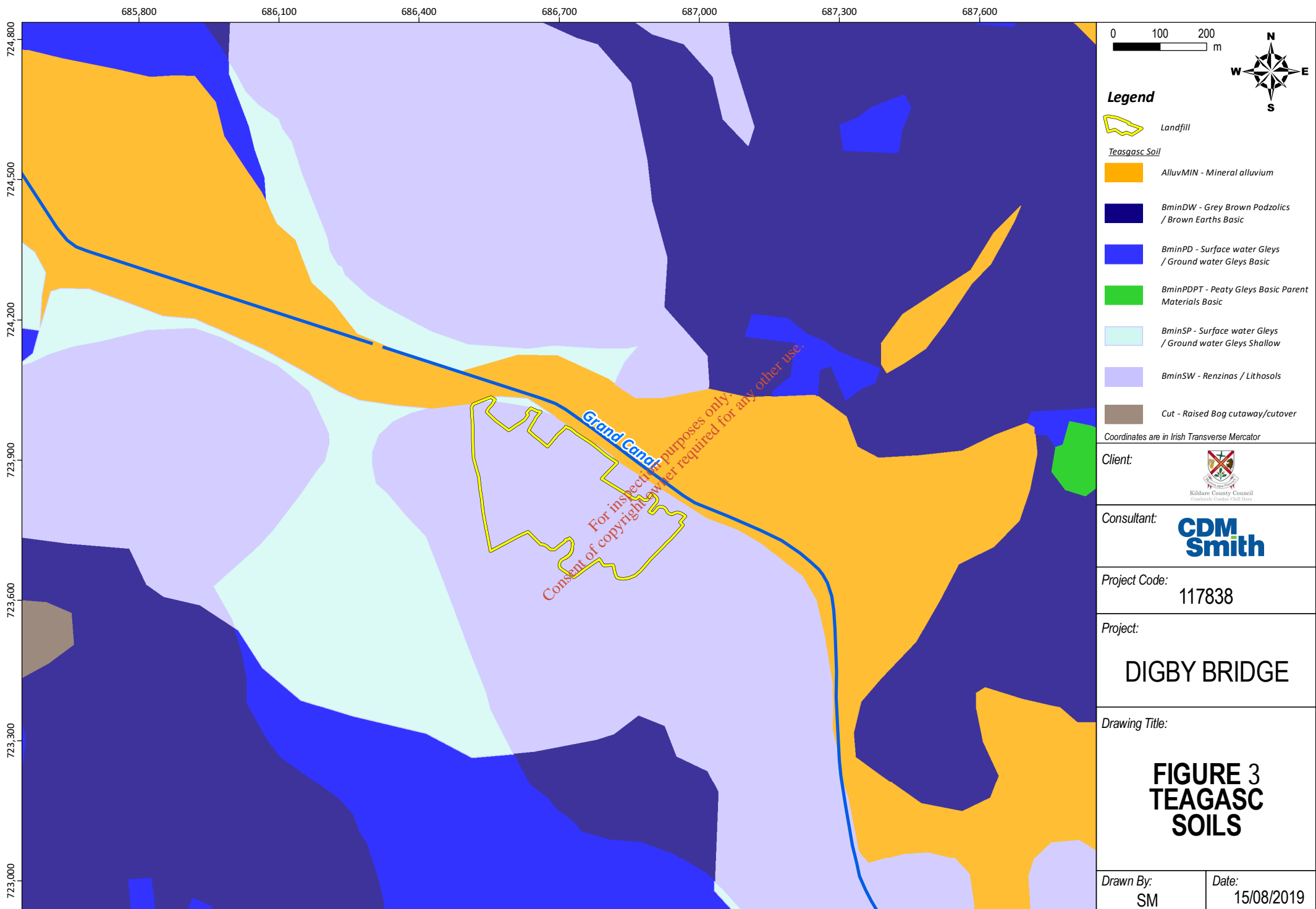
The Rickardstown Formation is known to be karstified in areas. The GSI National Karst map indicates there no mapped karst features on the site or within a 1km radius of the site. Two caves, identified as 2923SWK001 and 2923SWK002, are both located approximately 15km north-east of the site close to contacts between the Rickardstown Formation, Waulsortian Limestones and Tober Colleen Formation. The former and latter are mapped in the Waulsortian and Tober Colleen, respectively.

Pure bedded limestones are more susceptible to karstification and contain most karst landforms than impure (or mud or shale-rich) limestones.

2.4.4 Geological Heritage

The GSI database shows that there are no geological heritage features listed for the site or in its vicinity.







2.5 Hydrogeology

The GSI National Bedrock Aquifer map is shown as Figure 5, this identifies the site as being underlain by a Locally Important Karstified Aquifer (Lk), the Rickardstown Formation. The eastern boundary of the site is a 100 m from the intersection between the Rickardstown Formation (Lk) and the Waulsortian Limestones. The Waulsortian Limestones are classed as a Locally Important Aquifer (LI) and are moderately productive only in local zones. The Rickardstown Formation is commonly very cherty and often dolomitised. In areas where dolomitisation has been intense, groundwater yields are found to be high.

The gravel unit at the site has not been delineated and designated by the GSI as an aquifer unit, this is most likely due to its limited extents.

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics which determine the ease that contaminants may enter the groundwater. The GSI Groundwater Vulnerability map on Figure 6 shows that the site has been classed as 'H – High'.

According to the GSI database, there are potentially seven groundwater abstraction points within 1km of the site, four of which have a yield classed as poor, less than 35 m³/day.

The well records for the Rickardstown Formation in Co. Kildare indicate fissures and several water entries in the borehole logs, this data was gathered by the GSI for the Kildare Groundwater Protection Scheme Reports¹.

The site is not on a Public Source Protection Zone (SPZ) or that of a Group Water Scheme (GWS). The nearest SPZ is Robertstown Public Water Supply which is 4.8 km to the west of the site.

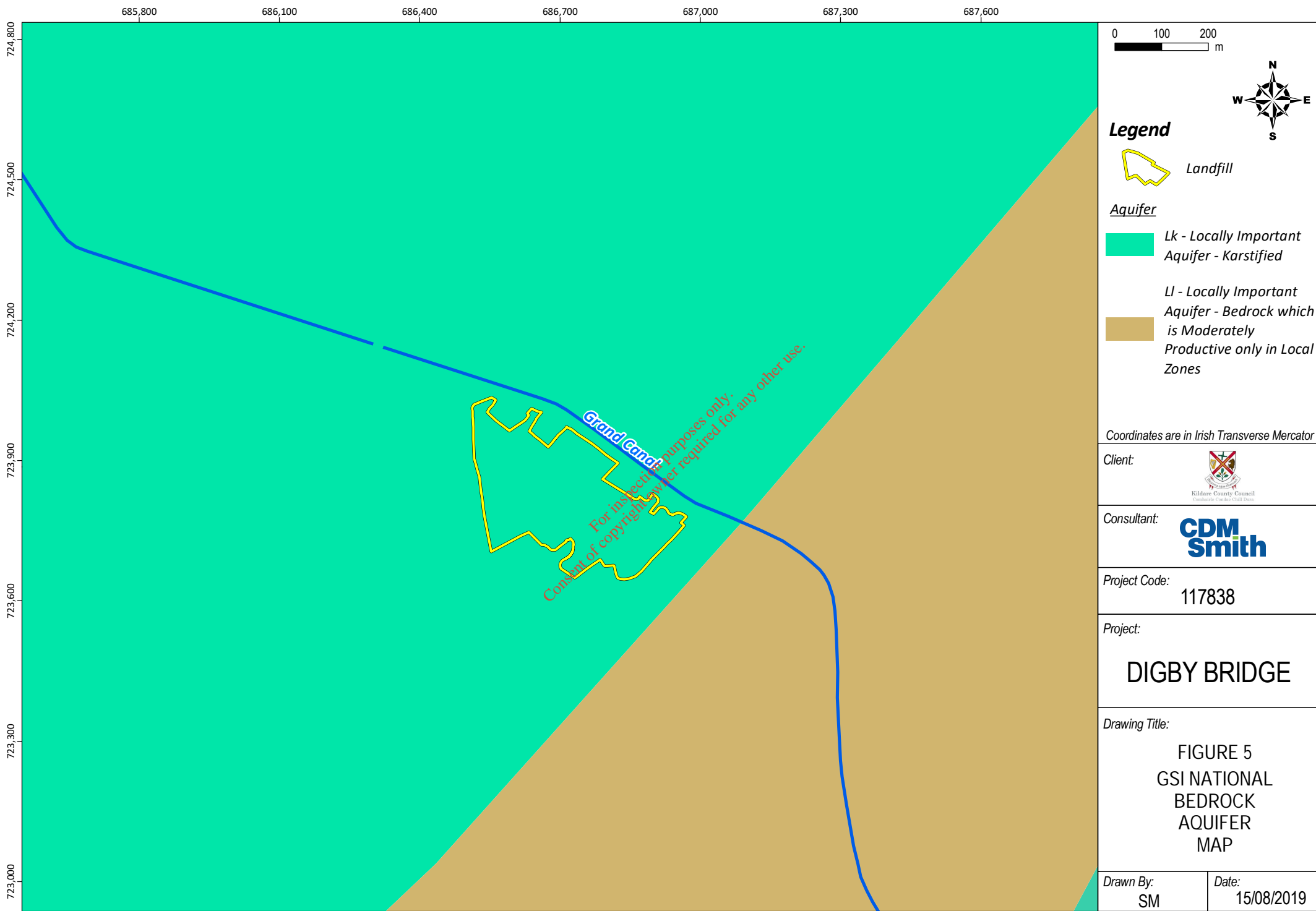
There is no groundwater quality available for the aquifer unit for the site. The site overlies the Naas Groundwater Body (GWB) under the WFD. The EPA has classed groundwater quality as good for the WFD 2010-2015, not based on sampling data.

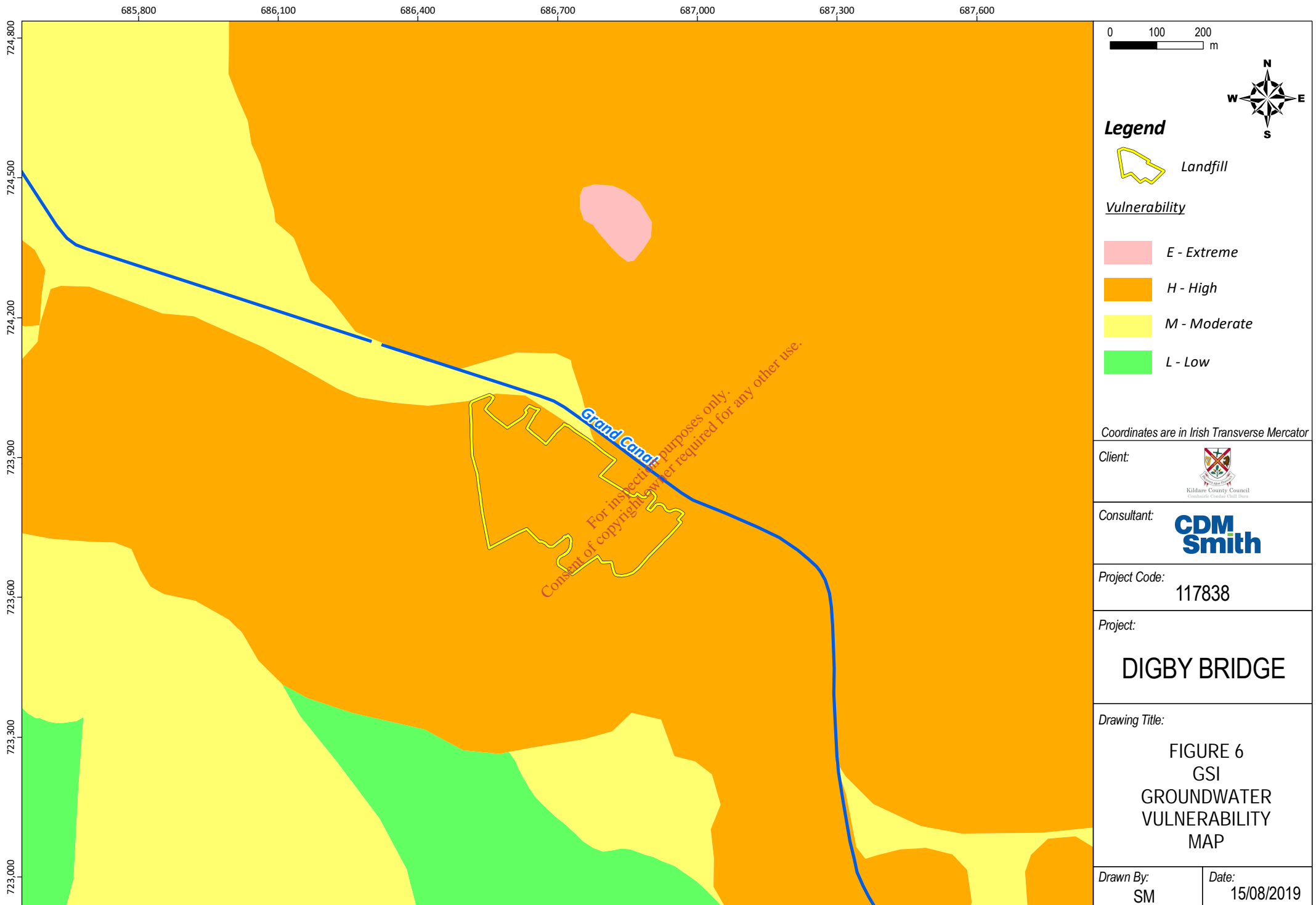
2.6 Hydrology

The site is in the WFD Eastern River Basin Districts (RBDs). The stretch of the River Liffey that runs east of the site has been classed as moderate (interim overall status).

Running along the northern boundary is the Grand Canal, which starts at Shannon Harbour and finishes at Grand Canal Dock in Dublin. It is a navigable waterway with water flowing from west to east. The River Liffey is approximately 1km to the south east of the site, and the Grand Canal crosses the River Liffey via an aqueduct. There are no streams which flow through the site. The EPA surface water body map shows two streams mapped 140 m north east of the site (other side of canal) as tributaries of the River Liffey. A drainage ditch exists to the northwest of the site, which separates the main field with the yard of the adjacent house.

¹ Geological Survey Ireland, 2002. Kildare Groundwater Protection Scheme Report





2.7 Designated Sites

The Grand Canal, which comes to within 50 m of the southern boundary of the site is a proposed Natural Heritage Area. The site is not otherwise within or directly adjacent to any Natural Heritage Area (NHA), Special Area of Conservation (SAC) or Special Protection Area (SPA).

The following SACs and SPAs are located within 10 km of the site. A number of these are also listed as pNHAs:

- Grand Canal pNHA (002104) – approximately 50 m to the north of the site;
- Ballynafagh Bog SAC (000391) – approximately 5.7 km to the north west;
- Ballynafagh Lake SAC (00713) – approximately 7.1 km to the north west;
- Hodgestown Bog NHA (001393) – approximately 8.7 km to the north west; and
- Mouds Bog SAC (002331) - approximately 7.9 km to the north east.

2.8 Licenced Sites

A search of the EPA Maps resource returned three licensed sites within 4km of the site. The details of which are listed in Table 2.

Table 2: Summary of Local EPA Licensed Sites

Location	Reg No.	Category
1.5 km west of site	A0112-01	Urban Waste Water
2.75 km south east of site	P0819-01	Industry
3.5 km south east of site	P0805-01	Industry

The nearest registered landfill on the EPA database is the closed landfill at Kerdiffstown, Co. Kildare, which is located 4 km to the south east of the site.

2.9 Planning History

The Kildare County Council planning database was reviewed and a total of 13 planning applications were found within 500m of the site centre-point, as shown in Table 3.

Table 3: Summary of Nearby Planning Applications

Location	Planning ID	Description	Status	Decision	Year
140 m west of site	97720	Reinstatement and raising of lands for agricultural benefit using inert subsoil and topsoil	Decision Made	Refuse	2003
60 m south of site	82016	Retention of stable development	Application Finalised	Grant	2003
140 m north west of site	66134	Restore and rehabilitate lands for grazing	Decision Made	Refuse	2004
Near site*	68318	Dormer bungalow and septic tank	Application Finalised	Grant	2004
60 m east of site	72478	Two storey dwelling house, domestic effluent treatment system and percolation area	Application Finalised	Grant	2005
50 m south west of site	84013	Change of house design to that which was previously granted	Application Finalised	Grant	2008
30 m north east of site	83232	Retention of modifications to thatched cottage, including an extension to the rear of the dwelling.	Application Finalised	Grant	2008
125 m west of site	100893	Construction of a bungalow, domestic garage, septic tank with percolation area	Application Finalised	Refuse	2015
Central-north section of site	100724	Bungalow and effluent treatment plant	Application Finalised	Refuse	2015
10 m west of site	101543	Removing condition of planning relating to sterilisation of lands, constructing a bungalow, detached domestic garage, septic tank with percolation area	Withdrawn	NA	2016
160 m west of site	102239	Removing condition of planning relating to sterilisation of lands, constructing a bungalow, detached domestic garage, septic tank with percolation area	Application Finalised	Grant	2016
30 m east of site	102743	Erection of an extension and garage, installation of septic tank and percolation area	Application Finalised	Grant	2016
Central-north section of site	101973	Stable building, feed store, tack room and dungstead	Withdrawn	NA	2016

*Application granted on the site, but development does not appear to have taken place

Section 3 Site History

3.1 Site History and Land Use

The Ordnance Survey Ireland (OSi) Map from (1837-1842), show gravel pits present and three buildings along the northern boundary of the site. These are in the footprints of buildings currently on the eastern and western sides of the northern site boundary. The land occupied by present-day buildings along the middle of the northern boundary is a green field. There is a gravel pit adjacent to the eastern boundary of the present-day site and there are gravel pits approximately 180 – 250 m to the south east of the site. The canal is to the north of the site and the surrounding land is predominantly used for agriculture.

The OSi Map from (1888-1913), shows an increase in size of the gravel pits with pathway access. The gravel on the eastern side (onsite) of the site has been connected to the gravel pit (offsite) on the opposite side of the site boundary. The south-eastern corner of the site, a gravel pit, approaches the location of a house which is present today. Buildings to the eastern and western sides of the northern boundary of site are still present. A present day building which is situated roughly in middle of the northern boundary is still on a green field.

The aerial photograph from 1995, shows that the pits have been infilled and are now used for agricultural land (grazing). The Grand Canal is to the north of the site. The gravel pits to the east appear to be partially infilled and/or overgrown, the boundaries are delineated by hedges and trees. The offsite pit adjacent to the eastern boundary of the site has been partially infilled. The present day building in the middle of the northern boundary is present on 1995 aerial photograph. In the south-eastern corner of the site there appears to be patch of exposed earth.

The aerial photograph from 2005, shows the site and off-site areas largely unchanged, apart from the addition of two buildings to the south of the site; residential and/or farm related.

The aerial photograph from 2005-2012 shows no significant changes.

In the past, properties adjacent to the landfill had complained to the local authority about poor groundwater quality from their domestic wells. The local authority responded by providing public water supply connections to some properties in the area.

3.2 Landfill History

The understanding of the landfilling at the site is based on information provided by Kildare County Council, which included the project brief and data from the EPA Section 22 Register, the EPA Section 22 Register is included in **Appendix A**.

Landfilling started at the site in 20/06/1980, was operated until approximately 31/12/1982 and was privately-owned. As the main county landfill, the site was used for the disposal of municipal waste, as well as commercial. On the EPA Section 22 register, the waste that entered the landfill was classified as Waste Type A – Municipal and states that there was no hazardous waste landfilled at the site. The waste quantity is estimated at 100,000 tonnes.

The following risk assessment scores were assigned to the site:

- Leachate Risk Assessment Score: 35 Low Risk,

- Landfill Gas Risk Assessment Score: 70 High Risk, and
- Overall Risk Assessment Score: 70 Low Risk.

Post landfilling, the site was partially remediated by capping with an unknown depth of soil and is currently used by the owner for grazing farm animals. No monitoring infrastructure, landfill gas or leachate collection was installed.

3.3 Previous Investigations

Other than the Tier 1 Risk Assessment completed by Kildare County Council in 2008, the site has not been previously assessed, although a site investigation (SI) consisting of one borehole ("BH01") for a residential development was conducted in 2006. The borehole log is included in **Appendix C**. An additional borehole ("BH02") has been installed 140m to the east of site, the installation was a condition of planning approval for a domestic dwelling. The borehole log is included in **Appendix C**.

3.4 Preliminary Conceptual Site Model

Kildare County Council prepared a preliminary CSM in 2008 (included in **Appendix B**). To prepare for the Tier 2 and Tier 3 Risk Assessments, this preliminary CSM has been reviewed and updated where appropriate.

3.4.1 Potential Sources

Potential sources of contamination on the site comprise:

- Landfill material (waste mass);
- Leachate generated from the landfilled material;
- Contaminated groundwater plume;
- Landfill gas generated by anaerobic decay of organic material;
- Muck spreading (farmyard manure) / artificial fertiliser; and
- Pesticides / herbicides (farm related).

Potential off-site sources

- Infilled pits;
- Septic tanks / percolation areas;
- Fuel tanks (kerosene / green diesel); and
- Muck spreading (farmyard manure) / artificial fertiliser.

3.4.2 Potential Receptors

Potential receptors comprise the following:

- Groundwater in Quaternary gravels;

- Locally important karstified aquifer (Lk);
- Residential dwellings, farm related buildings;
- Groundwater (drinking water);
- Groundwater dependant ecosystems; and
- Surface water - Grand Canal and River Liffey;

3.4.3 Potential Pathways

- Migration of ground gases and/or vapours, through the gravel formation;
- Migration of leachate through the gravel to groundwater;
- Migration of leachate/percolation area/kerosene or fuel tank through groundwater through the gravel aquifer:
 - Supply of residential dwelling;
 - Grand Canal; and
 - Rickardstown Formation (locally important karstified aquifer).
- Migration of leachate/ percolation area/kerosene or fuel tank via groundwater through karstified aquifer:
 - Supply of residential dwelling; and
 - Grand Canal.
- Leaching / dissolution of contaminant in soils and subsequent migration via surface water.

An updated preliminary CSM is presented on Figure 7 and Figure 8.

3.5 Tier 1 Risk Assessment

Kildare County Council carried out a Tier 1 Risk Assessment in 2008 (included in **Appendix B**). To prepare for the Tier 2 and Tier 3 Risk Assessments, this has been reviewed and updated where appropriate. The methodology follows the EPA Code of Practice and is based on the principle of linkages between the Source, Pathway and Receptor, this provides a scoring system. The scores of the assigned components from the S-P-R linkages are listed in Table 4, the S-P-R values are calculated in Table 5.

From the desk study of the site, it was understood that a gravel layer is the only strata between the potential leachate of the waste body and the bedrock of the Rickardstown Formation (locally important karstified aquifer). Therefore, there is no significant geological barrier above the aquifer and an extreme vulnerability can be assigned. There is overland flow of surface water from the landfill associated with the drainage of precipitation. Although there is no point where leachate is visibly ponding on the landfill, a direct connection between drainage ditches associated with the waste body and the Grand Canal is assumed.

Table 4: S-P-R Linkage Scores

EPA Ref	Risk	Points	Rationale
1a	Leachate; source/hazard scoring matrix, based on waste footprint.	7	Municipal waste and a footprint of >1 and ≤5 ha
1b	Landfill gas; source/hazard scoring matrix, based on waste footprint.	7	Municipal waste and a footprint of >1 and ≤5 ha
2a	Leachate migration: Pathway (Vertical)	3	GSI describes the groundwater vulnerability as Moderate
2b	Leachate migration: Pathway (Horizontal)	5	The bedrock is classified by the GSI as a Locally Important Aquifer (LI) – bedrock which is moderately productive only in Local Zones
2c	Leachate migration: Pathway (Surface water drainage)	2	No connection
2d	Landfill gas: Pathway (Lateral migration potential)	3	Gravels (Section 2.4.1)
2e	Landfill gas: Pathway (Upwards migration potential)	5	Gravels (Section 2.4.1)
3a	Leachate migration: Receptor (Human presence)	3	Residential properties and buildings within 50 m of the waste mass
3b	Leachate migration: Receptor (Protected areas – SWDTE or GWDTE) (Surface water/ groundwater dependent terrestrial ecosystems)	3	Grand Canal (pNHA Listing) within 50m of the waste mass
3c	Leachate migration: Receptor (Aquifer category – Resource potential)	3	The aquifer has been classed as locally important, the data available for nearby well yields indicates poor well yields.
3d	Leachate migration: Receptor (Public water supplies – other than private wells)	0	No public water supply within 1 km, based on GSI database.
3e	Leachate migration: Receptor (Surface water bodies)	3	Grand Canal (pNHA Listing) within 50m of the waste mass
3f	Landfill Gas: Receptor (Human presence)	5	Residential properties and buildings within 50 m of the waste mass

The scores of each of the components of a S-P-R linkage are combined to give a total S-P-R value in Table 4. The maximum possible score for a S-P-R linkage is shown on Table 5. The normalised score for each S-P-R linkage is the S-P-R value as a percentage of the total score. The normalised score is categorised as high, medium or low risk based on the ranking provided for normalised score in Table 6.

Table 5: S-P-R Values for each S-P-R Linkage as per CoP with Normalised Scores

Calculator		S-P-R Values	Maximum	Linkage	Normalised Score (%)
Leachate migration through combined groundwater and surface water pathways					
SPR1	$1a \times (2a + 2b + 2c) \times 3e$	210	300	Leachate => surface water	70
SPR2	$1a \times (2a + 2b + 2c) \times 3b$	210	300	Leachate => SWDTE	70
Leachate migration through groundwater pathway					
SPR3	$1a \times (2a + 2b) \times 3a$	168	240	Leachate => human presence	70
SPR4	$1a \times (2a + 2b) \times 3b$	168	240	Leachate => GWDTE	70
SPR5	$1a \times (2a + 2b) \times 3c$	168	400	Leachate => Aquifer	42
SPR6	$1a \times (2a + 2b) \times 3d$	0	560	Leachate => Surface Water	0
SPR7	$1a \times (2a + 2b) \times 3e$	168	240	Leachate => SWDTE	70
Leachate migration through surface water pathway					
SPR8	$1a \times 2c \times 3e$	42	60	Leachate => Surface Water	70
SPR9	$1a \times 2c \times 3b$	42	60	Leachate => SWDTE	70
Landfill gas migration pathway (lateral & vertical)					
SPR10	$1b \times 2d \times 3f$	105	150	Landfill Gas => Human Presence	70
SPR11	$1b \times 2e \times 3f$	175	250	Landfill Gas => Human Presence	70
Site maximum SPR Score					70
Risk Classification					Highest Risk (Class A)

Table 6: Risk Classification

Risk Classification	Range of Risk Scores
Highest Risk (Class A)	Greater than or equal to 70% for any individual S-P-R linkage
Moderate Risk (Class B)	Between 40-70% for any individual SPR linkage
Lowest Risk (Class C)	Less than or equal to 40% for any individual SPR linkage

There are nine SPR linkages assessed as having a high risk, two of which are combined groundwater and surface water pathways (SPR1 and SP2), three of which are leachate migration through groundwater (SPR3, SPR4 and SPR7), two of which are leachate migration through surface water (SPR8 and SPR9) and two of which are the landfill gas risk to residential and other buildings (SPR10 and SPR11).

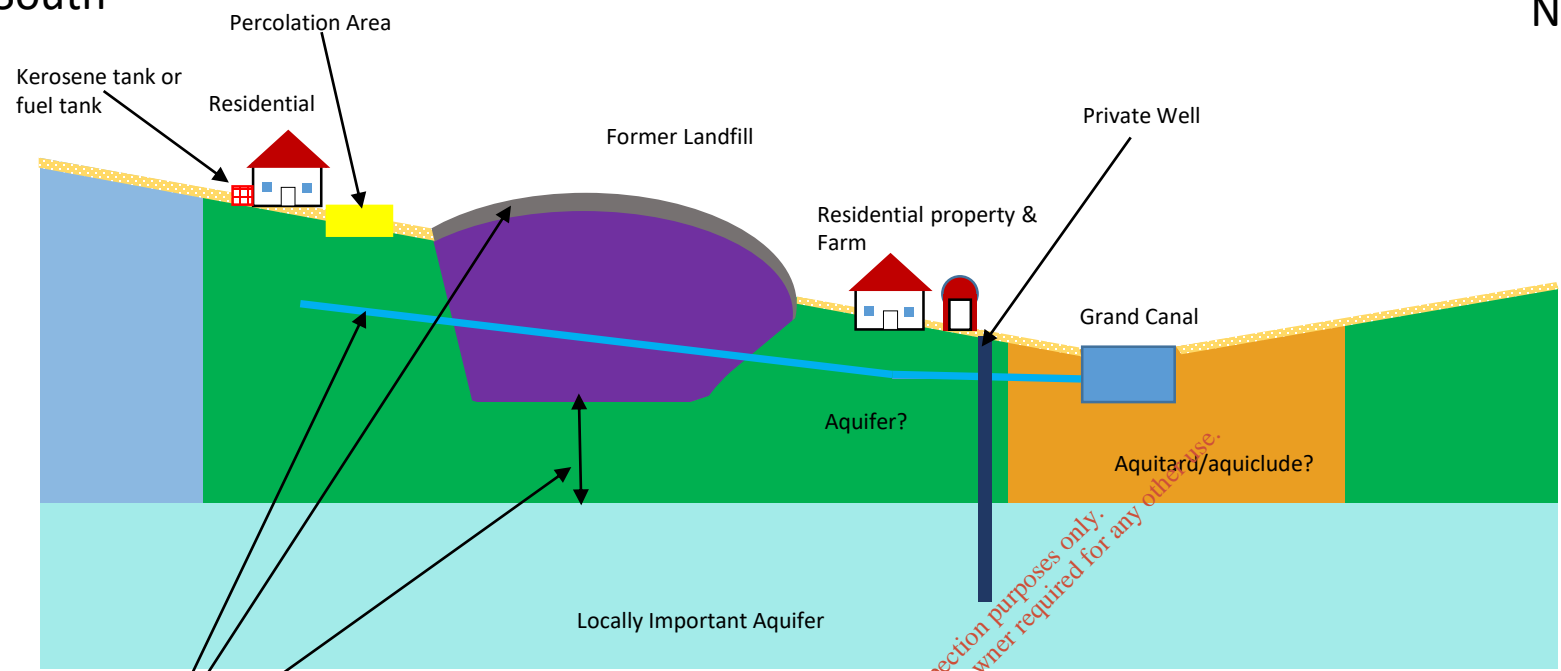
There is one SPR linkage assessed as having a moderate risk, which is leachate migration through groundwater (SPR5).

Based on the 'Highest Risk (Class A)' classification for the site, a Tier 2 for site investigation and testing is necessary.

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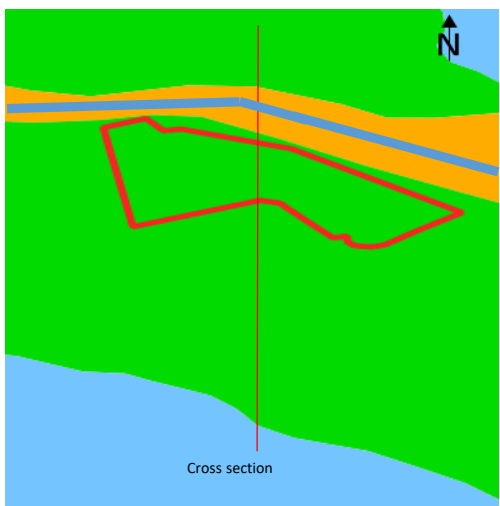
South

North



Unknowns

1. Thickness and composition of deposits below the waste mass, is there a confining layer Between gravel deposits and the Rickardstown Formation .
2. Thickness and composition of the landfill cover.
3. The position of the water table, flow direction, connectivity with canal and waste mass.
4. Waste mass extents, composition and presence of leachate.



GSI Map – Quaternary Deposits



Legend

Made Ground	
[Grey]	Landfill cover
[Purple]	Landfill mass
Quaternary Deposits	
[Orange]	Top soil
[Green]	Gravel (GLs)
[Light Blue]	Alluvium (A)
[Dark Blue]	Till (TLs)
Bedrock	
[Light Blue]	Rickardstown Formation (CDRICK)

Rev.	Description	By	Date	Chk'd	Auth

FOR INFORMATION / COMMENT			

Purpose of Issue	Rev	Date	Authorised

CDM Smith
Consulting Engineers
Wentworth,
15, Eblana Villas,
Dublin 2, Ireland,
D02 WK10
Tel. (01)232 1044

Client
Kildare County Council

Project
Digby Bridge

Title
Preliminary
Site Conceptual Model

Original Scale NTS	Drawn CMC Date 03/01/19	Checked CF Date 06/08/19	Authorised BOC Date 14/08/19	Ad
-----------------------	-------------------------------	--------------------------------	------------------------------------	----

Drawing Number
FIGURE 7

Rev
A

Appendix A Section 22 Register

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WMA Section 22 Register:

Monday 25 August 2008

Last login

New - Site Details

Source of Information

Site Details

- New site details
- Edit site details

Site Activity Details

- New activity details
- Edit activity details

Site Status Details

- New status details
- Edit status details

My Contact Details /
Password change

Contact EPA

Manual (PDF - 4.2MB)

Log Out

Please enter new site details by completing the form below

Fields marked with a (*) are mandatory

Site name:	<input type="text" value="Digby bridge"/>	*
Category:	<input type="text" value="Local Authority"/>	*
Local Authority Area:	<input type="text" value="Kildare County Council"/>	*
Townland:	<input type="text" value="Digby Bridge, Barrettstown"/>	*
Town:	<input type="text" value="Sallins"/>	*
County:	<input type="text" value="Kildare"/>	*
Grid Coordinates: (6 digit no.)	<input type="text" value="223680"/>	X *
	<input type="text" value="286962"/>	Y *
	<input type="button" value="Save"/>	

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WMA Section 22 Register:

Monday 25 August 2008

Last login

New - Site Activity Details

Source of Information

Site Details

- New site details
- Edit site details

Site Activity Details

- New activity details
- Edit activity details

Site Status Details

- New status details
- Edit status details

My Contact Details /
Password change

Contact EPA

Manual (PDF - 4.2MB)

Log Out

Please enter site status details by completing the form

Fields marked with a (*) are mandatory

Site Name:	<input type="text" value="Digby bridge"/>	*
Activity description:	<input type="text" value="Kildare County Council refuse Depot"/>	
Start date :	<input type="text" value="20/06/1980"/>	*
End date:	<input type="text" value="31/12/1982"/>	*
Holder of waste	<input type="text" value="Kildare County Council"/>	*
Site Owner:	<input type="text" value="Patrick Walsh"/>	*
Waste Activity:	<input type="text" value="Disposal"/>	*
Waste Type A:	<input type="text" value="Municipal"/>	*
Waste Type B:	<input type="text" value="Other"/>	*
Waste Type C:	<input type="text" value="Unknown"/>	*
Hazardous waste present?:	<input type="radio"/> yes <input checked="" type="radio"/> no	*
Est. Waste quantity:	<input type="text" value="100000"/>	*
Est. Landfill Area	<input type="text" value="4"/>	*
Verification Method:	<input type="text" value="LA Records"/>	*
Comments:	<div><div></div><div>(Maximum characters: 500)</div><div>You have 500 characters left.</div></div>	
	<input type="button" value="Save"/>	

ymurray@kildarecoco.ie | [Logout](#)

Waste Management Act Section 22 Register

Home[Site Details](#)[Risk Assessment](#)[Useful Information](#)[Contact EPA](#)[Landfill WebGIS](#)**Administration**[Manage Sites](#)[Reports](#)[Maps](#)[Email Users](#)**Site Name: Digby Bridge,
Barrettstown, Sallins**

Status of Facility

Unregulated

Permit or License can be obtained
from:

Local Authority

Click [here](#) for the Walkover Survey
Checklist**SPR Linkages**

SPR 1 score

28

SPR 2 score

28

SPR 3 score

35

SPR 4 score

35

SPR 5 score

21

SPR 6 score

0

SPR 7 score

35

SPR 8 score

0

SPR 9 score

0

SPR 10 score

70

SPR 11 score

70

Overall Risk Assessment Score

70

Class of Site

A

Summary Report

Facility Description

Kildare County Council Refuse Depot

Receiving Environments

Known Impacts

Emissions observed/recorded

Remediation Measures

Technical Requirements

Treatment Methods

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Save

Cancel

Save and Run Report

**Unauthorised Waste Sites Register : Monday 8 September 2008****Status Details**

Status of facility:	Licence Applied
Permit/Licence can be obtained from:	EPA
S-P-R 1 Linkage Score:	28
S-P-R 2 Linkage Score:	28
S-P-R 3 Linkage Score:	35
S-P-R 4 Linkage Score:	35
S-P-R 5 Linkage Score:	21
S-P-R 6 Linkage Score:	21
S-P-R 7 Linkage Score:	21
S-P-R 8 Linkage Score:	0
S-P-R 9 Linkage Score:	0
S-P-R 10 Linkage Score:	35
S-P-R 11 Linkage Score:	21
Leachate Risk Assessment Score	35
Comments:	Low Risk
Landfill Gas Risk Assessment Score	35
Comments:	Low Risk
Overall Risk Assessment Score	35
Comments:	Low Risk
Remediation Measures:	To Be Determined
Summary Report on:	
Facility Description:	Kildare County Council Refuse Depot
Receiving Environment:	Not Known
Known Impacts:	Not Known
Emissions observed/recorded:	Not Known
Technical Requirements:	To Be Determined
Treatment Methods:	To Be Determined



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Kildare County Council

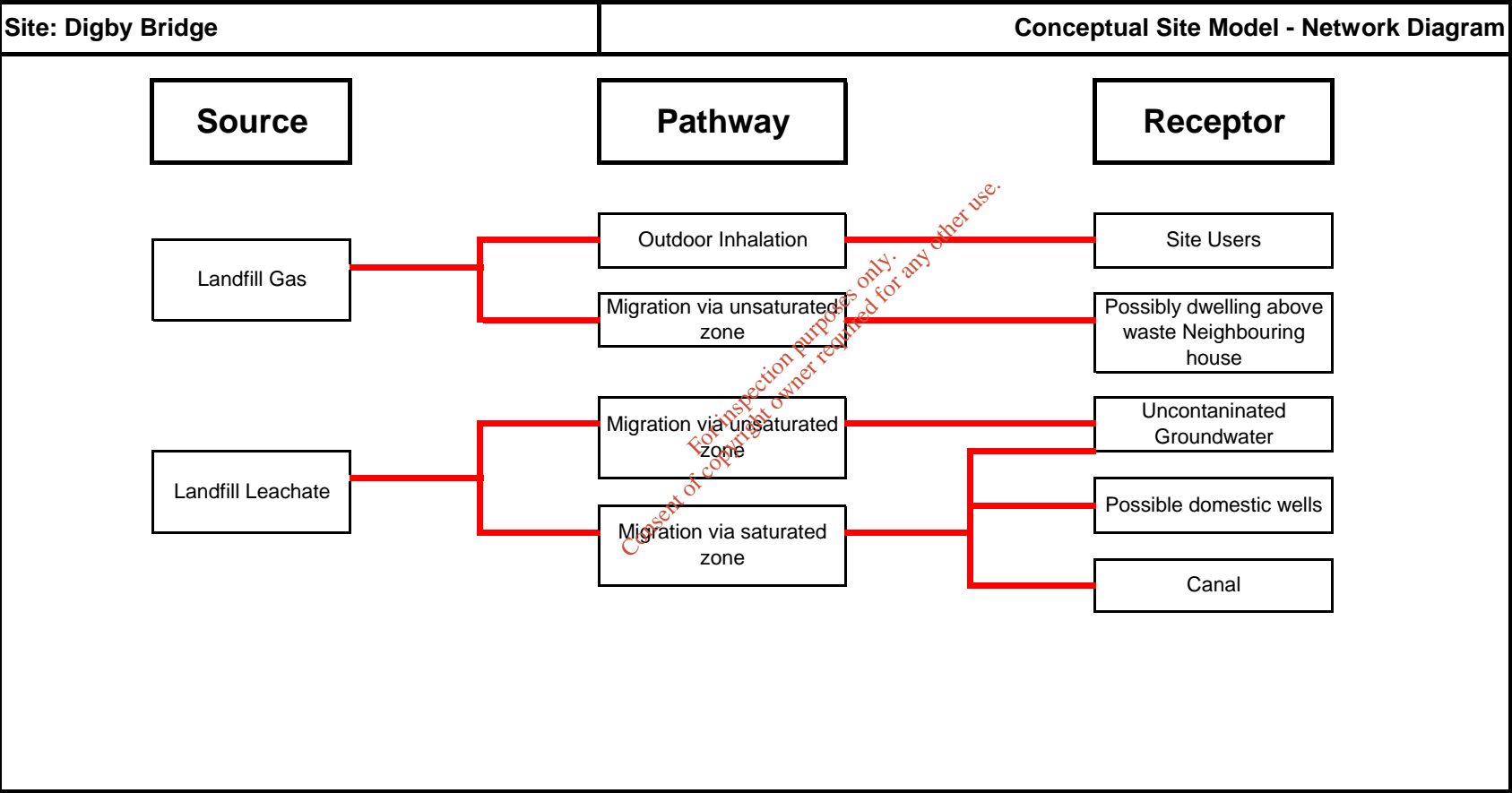
Environment Section



Waste Management Act 1996 - 2008 Section 22 Sites

Digby Bridge.

Conceptual Site Model and Risk Assessment.



Site : DIGBY BRIDGE

Table	Score	Rationale
1a: Leachate Hazard	7	Waste body contains Municipal waste footprint >1and<5ha
1b: Landfill Gas Hazard	7	Waste body contains Municipal waste footprint >1and<5ha
2a: Leachate Migration - GW Vulnerability	2	High Vulnerability
2b: Leachate Migration - GW Flow Regime	5	Karsified Groundwater bodies (Rk)
2C: Leachate Migration - SW Drainage	0	No direct connection to surface water, in disused quarry.
2d: Landfill Gas - Lateral Migration	3	Sand and gravel, Made ground, urban, Kars
2e: Landfill Gas - Vertical Migration	5	Sand and gravel, Made ground, urban, Kars
3a: Leachate Migration - Human Presence	3	House within 50m of waste body
3b: Leachate Migration - Protected Area	3	Grand Canal located within 50m of waste b PNHA
3c: Leachate Migration - Aquifer Category	3	Lg - locally important aquifer
3d: Leachate Migration - Public Water Supply	0	No public water supply within 1km and not a karst aquifer
3e: Leachate Migration - Surface Watewr Bobied	3	Waste body approx. <50m from Grand Canal
3f: Landfill Gas - Human Presence	5	House within 50m of waste body

SPR (Source Pathway Receptor) Linkage

SPR 1= 1a X (2a + 2b + 2c) X 3e
 SPR 2= 1a X (2a + 2b + 2c) X 3b (SWDTE)
 SPR 3= 1a X (2a + 2b) X 3a
 SPR 4= 1a X (2a + 2b) X 3b
 SPR 5= 1a X (2a + 2b) X 3c
 SPR 6= 1a X (2a + 2b) X 3d
 SPR 7= 1a X (2a + 2b) X 3e
 SPR 8= 1a X 2c X 3e
 SPR 2= 1a X 2c X 3b (SWDTE)
 SPR 10= 1b X 2d X 3f
 SPR 11= 1b X 2e X 3f

	Site score	Max score	%
SPR 1:	147	300	49.00%
SPR 2:	147	300	49.00%
SPR 3:	147	240	61.25%
SPR 4:	147	240	61.25%
SPR 5:	147	400	36.75%
SPR 6:	0	560	0.00%
SPR 7:	147	240	61.25%
SPR 8:	0	60	0.00%
SPR 9:	0	60	0.00%
SPR 10:	105	150	70.00%
SPR 11:	175	250	70.00%

High Risk (Class A) site

Site: Digby Bridge

Table 1a: LEACHARE: SOURCE/HAZARD SCORING MATRIX

WASTE TYPE	WASTE FOOTPRINT (ha)		
	≤ 1 ha	>1 ≤ 5 ha	> 5 ha
C&D ²⁰	0.5	1	1.5
Municipal ²¹	5	7	10
Industrial ²²	5	7	10
Pre 1977 sites ²³	1	2	3
		Max	10

1a 7

Table 1b: LANDFILL GAS: SOURCE/HAZARD SCORING MATRIX

WASTE TYPE	WASTE FOOTPRINT (ha)		
	≤ 1 ha	>1 ≤ 5 ha	> 5 ha
C&D ²⁰	0.5	1	1.5
Municipal ²¹	5	7	10
Industrial ²²	5	7	10
Pre 1977 sites ²³	1	2	3
		Max	10

1b 7

Table 2a: LEACHATE MIGRATION: PATHWAYS

Parameter	Points available
GROUNDWATER FLOW REGIME (Vertical Pathway)	
Extreme Vulnerability	3
High Vulnerability	2
Moderate Vulnerability	1
Low Vulnerability	0.5
High - Low Vulnerability	2

2a 2

Table 2b: LEACHATE MIGRATION: PATHWAYS

Parameter	Points available
GROUNDWATER FLOW REGIME (Horizontal Pathway)	
Karstified Groundwater bodies (Rk)	5
Productive Fissured Bedrock Groundwater Bodies (Rf and Lm)	3
Gravel Groundwater bodies (RG and Lg)	2
Poorly Productive Bedrock Ground Water Bodies (LI, PI, PU)	1

2b 5

Table 2c: LEACHATE MIGRATION: PATHWAYS

Parameter	Points available
SURFACE WATER DRAINAGE (surface water pathway)	
Is there a direct connection between drainage ditches associated with the waste body and adjacent surface water body? Yes	2
If no direct connection	0

2c 0

Table 2d: LANDFILL GAS: PATHWAY assuming receptor within 250m of source

Parameter	Points available
LANDFILL GAS LATERAL MIGRATION POTENTIAL	
Sand and gravel, Made ground, urban, Karst	3
Bedrock	2
All other Tills (including limestone, sandstone etc - moderate Permeability)	1.5
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

2d	3
----	---

Table 2e: LANDFILL GAS: PATHWAY assuming receptor located above source

Parameter	Points available
LANDFILL GAS LATERAL MIGRATION POTENTIAL	
Sand and gravel, Made ground, urban, Karst	5
Bedrock	3
All other Tills (including limestone, sandstone etc - moderate Permeability)	2
All Namurian or Irish Sea Tills (low permeability)	1
Clay, Alluvium, Peat	1

2e	5
----	---

Table 3a: LEACHATE MIGRATION: RECEPTORS

Parameter	Points available
HUMAN PRESENCE (presence of a house indicates potential private well)	
On or within 50m of waste body	
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km of the waste body	1
Greater than 1km of the waste body	0

3a	3
----	---

Table 3b: LEACHATE MIGRATION: RECEPTORS

Parameter	Points available
PROTECTED AREAS (SWDTE or GWDTE)	
On or within 50m of waste body	3
Greater than 50m but less than 250m of the waste body	2
Greater than 250m but less than 1km of the waste body	1
Greater than 1km of the waste body	0
Undesignated sites within 50m of waste body	1
Undesignated sites greater than 50m but less than 250m of the waste body	0.5
Undesignated sites greater than 250m of the waste body	0

3b	3
----	---

Table 3c: LEACHATE MIGRATION: RECEPTORS

Parameter	Points available
AQUIFIER CATEGORY (resource potential)	
Regionally Important Aquifer (Rk, Rf, Rg)	5
Locally Important Aquifer (LI, Lm, Lg)	3
Poor Aquifer (PI, Pu)	1

3c	3
----	---

Table 3d: LEACHATE MIGRATION: RECEPTORS

Parameter	Points available
PUBLIC WATER SUPPLY (other than private wells)	
Within 100m of site boundary	7
Greater than 100m but less than 300m or within Inner SPA (SI) for GW supplies	5
Greater than 300m but less than 1km or within Outer SPA (SO) for GW supplies	3
Greater than 1km (karst aquifer)	3
Greater than 1km (no karst aquifer)	0

3d	0
----	---

Table 3e: LEACHATE MIGRATION: RECEPTORS

Parameter	Points available
SURFACE WATER BODIES	
Within 50m of site boundary	3
Greater than 50m but less than 250m	2
Greater than 250m but less than 1km	1
Greater than 1km	0

3e	3
----	---

Table 3f: LANDFILL GAS: RECEPTORS

Parameter	Points available
HUMAN PRESENCE	
On site or within 50m of site boundary	5
Greater than 50m but less than 150m	3
Greater than 150m but less than 250m	1
Greater than 250m	0.5

3f	5
----	---

Walkover Survey Checklist		
Information	Checked	Comment (include distances from site boundary)
1. What is current Land Use?		Footprint of waste may extend into lands owned by a number of difference landowners. Land use mainly agriculture- animals grazing. Possible that waste may extend under/near residential property, farm buildings, driveway to residence.
2. What are the neighbouring Land Uses?		Residential housing, farm buildings
3. What is the size of the site?		approximately 4.5 hectares
4. What is the topography?		sloping towards road/canal
5. Are there potential receptors (if yes, give details)?		Yes
Houses		Number of residential properties adjoining, one may be built on waste. Farm buildings also adjoining.
Surface water features (if yes, distance and direction of flow)		Grand Canal (pNHA) opposite side of narrow road
Any wetland or protected areas		
Public Water Supplies		
Private Wells		Possible wells, although area is served by mains water
Services		
Other buildings		Farm Buildings
Other		
6. Are there any potential sources of contamination (if yes, give details)?		no visible or detectable signs of contamination
Surface waste (if yes, what type?)		
Surface ponding of		

leachate		
Leachate seepage		
Landfill gas odours		
7. Are there any outfalls to surface water? (If yes, are there discharges and what is the nature of the discharge?)		No
8. Are there any signs of impact on the environment? (If yes, take photographic evidence)		No
Vegetation die off, bare Ground		
Leachate seepages		
Odours		
Litter		
Gas bubbling through water		
Signs of settlement, subsidence, water logged areas		some minor settlement
Drainage or hydraulic issues		
Downstream water quality appears poorer than upstream water quality		
9. Are there any indications of remedial measures? (Provide details)		Yes
Capping		Site capped and seeded. Exact details and depths unknown
Landfill gas collection		

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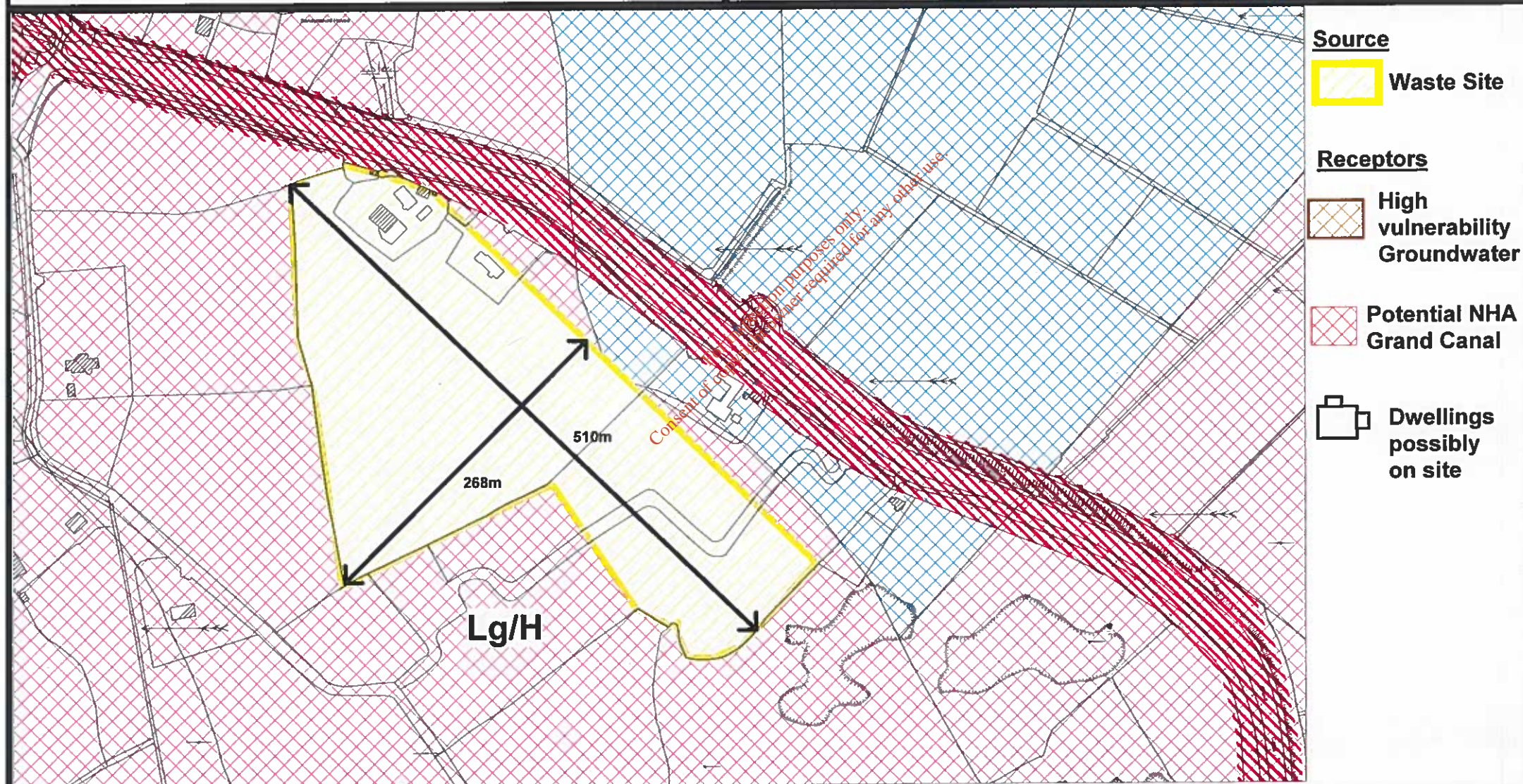
Leachate collection		
10. Describe fences and security features (if any)		Land within ownership of a few different owners, each fenced off from next.
Any other relevant information?		

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Site: Digby Bridge

Conceptual Site Model - Site Plan Rev1





Site: Digby Bridge

Conceptual Site Model - Site Section Rev1

P1: Outdoor Inhalation
P2: Unsaturated Zone
P3: Saturated Zone
P4: Gas Migration.

Source

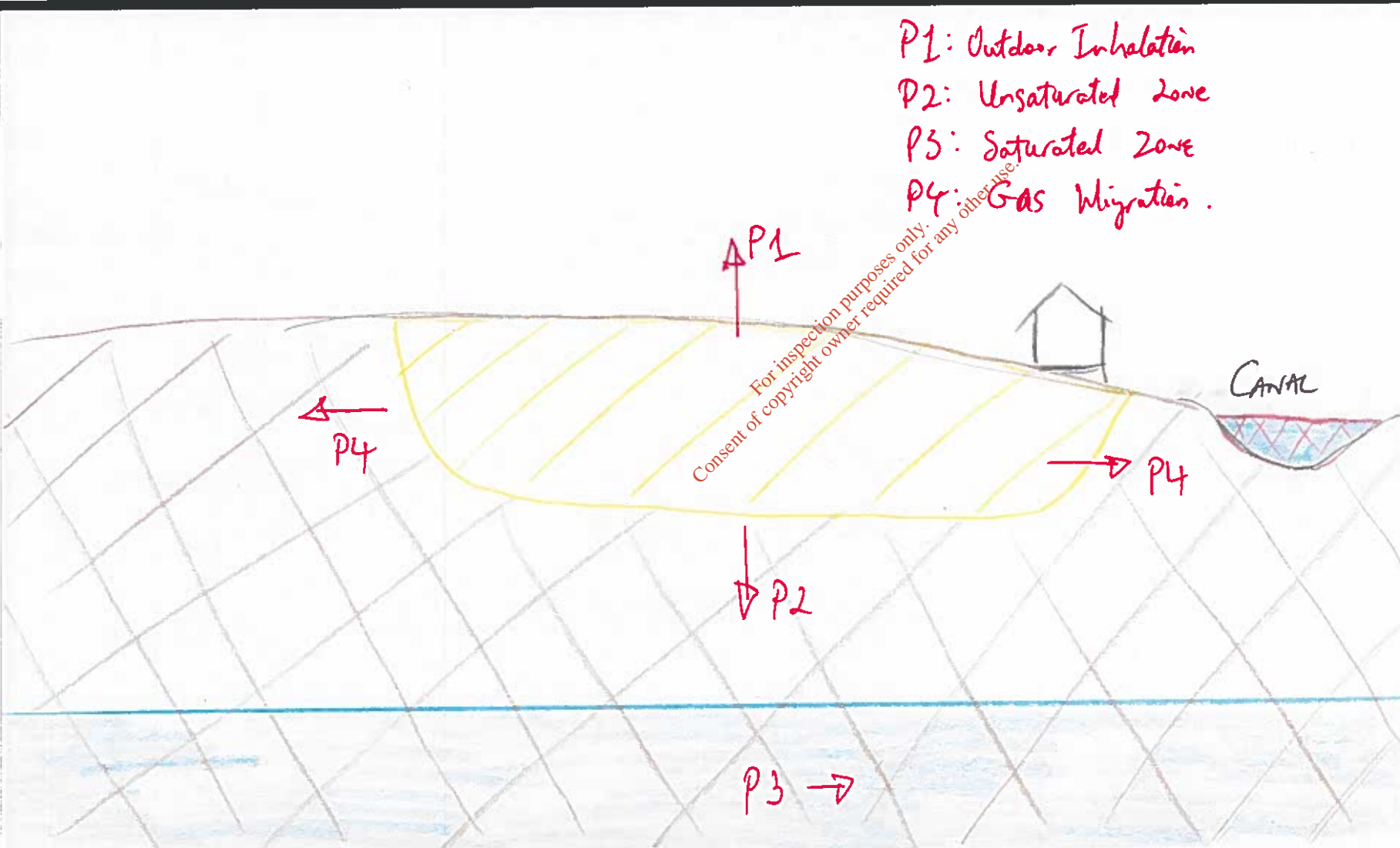
 Waste Site

Receptors

 High vulnerability Groundwater

 Potential NHA Grand Canal

 Dwellings possibly on site



Appendix C Historical Ground Investigation Logs

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GEOTECHNICAL BORING RECORD

REPORT NUMBER

12153

CONTRACT Digby Bridge Naas

BOREHOLE NO. BH1

SHEET Sheet 1 of 1

CO-ORDINATES(_)

GROUND LEVEL (m)

BOREHOLE DIAMETER (mm) 200

DATE STARTED 28/09/2006

DATE COMPLETED 30/09/2006

CLIENT

ENGINEER John Nash Consulting Engineers

BOREHOLE DEPTH (m) 6.50

CASING DEPTH (m) 7.50

BORED BY McDonnell

PROCESSED BY Femi

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples			Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)		
0	brown sandy CLAY/ Topsoil								
1	Medium dense grey slightly silty SAND with occasional fine gravel			0.50	4120	B	1.00	N = 22 (3, 6, 5, 5, 6, 6)	
2					4121	B	2.00	N = 30 (3, 5, 7, 8, 9, 6)	
3	Dense grey fine to coarse sandy GRAVEL with occasional cobble and boulder			2.50	4122	B	3.00	N = 36 (4, 5, 7, 8, 10, 11)	
4					4123	B	4.00	N = 51/200 mm (7, 9, 11, 15, 25)	
5					4124	B	5.00	N = 25/50 mm (9, 10, 25)	
6					4125	B	6.00	N = 59/200 mm (9, 11, 15, 19, 25)	
7					2427	B	7.00	N = 50/25 mm (50)	
8	End of Borehole at 6.50 m			7.50					
9									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
4.4	4.7	1	
5.3	5.6	1	
6.3	6.5	0.75	
7.3	7.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments

GROUNDWATER DETAILS

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
30/09/2006	7.50	1.00	7.50	50mm SP	30-09-06	7.50	7.50	0.00	Dry

REMARKS Waiting for site to be ready, made access into the field with a mini digger - water bowser provided to drill gravels

Sample Legend

D - Small Disturbed (tub)

B - Bulk Disturbed

L3 - Large Bulk Disturbed

Env - Environmental Sample (Jar + Vial + Tub)

U - Undisturbed 100mm Diameter Sample

P - Undisturbed Piston Sample

IGSL BH LOG 12153.GPJ IGSL.GDT 10/10/06



GEOTECHNICAL BORING RECORD

REPORT NUMBER

20126

CONTRACT Digby Bridge, Sallins

BOREHOLE NO. BH01

CO-ORDINATES

SHEET Sheet 1 of 2

GROUND LEVEL (m AOD)

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 10.00DATE COMMENCED 12/05/2017
DATE COMPLETED 16/05/2017

CLIENT

ENGINEER Golders

SPT HAMMER REF. NO.
ENERGY RATIO (%)BORED BY E. Leahy
PROCESSED BY F.C.

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSDIL			0.10						
	Fine brown SAND			0.40						
	Brown sandy CLAY									
1	Firm brown sandy CLAY with gravel			1.10	AA68259	B	1.00		N = 13 (1, 3, 3, 3, 3, 4)	
				1.80						
2	Stiff brown CLAY with frequent gravel and occasional cobbles				AA68260	B	2.00		N = 23 (3, 4, 4, 6, 6, 7)	
3				3.30	AA68261	B	3.00		N = 29 (3, 5, 7, 7, 6, 7)	
	Medium dense to dense grey/brown slightly clayey sandy GRAVEL									
4				4.60	AA68262	B	4.00		N = 28 (2, 5, 6, 6, 6, 8)	
	Dense black clayey sandy GRAVEL with occasional cobbles									
5					AA68263	B	5.00		N = 46 (4, 8, 8, 12, 12, 13)	
6					AA68264	B	6.00		N = 50 (5, 10, 10, 12, 14, 14)	
7				7.30	AA68265	B	7.00		N = 25/75 mm (6, 17, 28)	
	Very dense angular GRAVEL with large cobbles									
8				8.20	AA68265	B	8.00		N = 25/75 mm (13, 25, 28)	
	Very dense brown very clayey sandy GRAVEL and cobbles									
9					AA68267	B	9.00		N = 25/75 mm (12, 21, 25)	
				9.80						
	Very dense angular COBBLES and BOULDER			10.00						

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.3	9.8	4		6.00	8.00	No	5.30	20	Moderate
9.8	10	1.5							

GROUNDWATER PROGRESS

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
16-05-17	10.00	1.00	10.00	50mm SP	15-05-17	8.80	9.80	7.90	End of 2nd day
					16-05-17	10.00	Nil	6.10	End of BH

REMARKS Hand dug inspection pit.

Sample Legend

D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 20126 BH.GPJ IGSL.GDT 18/5/17



GEOTECHNICAL BORING RECORD

REPORT NUMBER

20126

CONTRACT Digby Bridge, Sallins

BOREHOLE NO. BH01

CO-ORDINATES

RIG TYPE

Dendo 2000

SHEET Sheet 2 of 2

GROUND LEVEL (m AOD)

BOREHOLE DIAMETER (mm)

200

DATE COMMENCED 12/05/2017

BOREHOLE DEPTH (m)

10.00

DATE COMPLETED 16/05/2017

CLIENT

SPT HAMMER REF. NO.

BORED BY E. Leahy

ENGINEER Golders

ENERGY RATIO (%)

PROCESSED BY F.C.

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
10	End of Borehole at 10.00 m				AA88268	B	10.00		N = 25/75 mm (25, 25)	
11										
12										
13										
14										
15										
16										
17										
18										
19										

HARD STRATA BORING/CHISELLING

WATER STRIKE DETAILS

From (m)	To (m)	Time (h)	Comments	Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.3	9.8	4							
9.8	10	1.5							

GROUNDWATER PROGRESS

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type	Date	Hole Depth	Casing Depth	Depth to Water	Comments
16-05-17	10.00	1.00	10.00	50mm SP					

REMARKS Hand dug inspection pit.

Sample Legend

O - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 20126 BH.GPJ IGSL.GDT 16/5/17

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