

This report has been cleared for submission by *Marie O'Connor* Marie O'Connor, Programme Manager. Eve O'Sullivan, Programme Officer. Dated 29/03/2021



**OFFICE OF ENVIRONMENTAL
SUSTAINABILITY**

**INSPECTOR'S REPORT ON AN APPLICATION
FOR A CERTIFICATE OF AUTHORISATION
FOR A CLOSED LANDFILL**

TO:	Micheál Lehane, Director
FROM:	Ewa Babiarczyk, Inspector, Environmental Licensing Programme
DATE:	29 th March 2021
RE:	Application by Fingal County Council for a Certificate of Authorisation for a closed landfill at Barnageeragh Cove, Skerries, County Dublin . Certificate of Authorisation Register Number H0167-01 .

1. Application details

Type of facility:	Closed landfill as defined in the Regulations ¹ .
Original site ownership	Fingal County Council.
Current site ownership	Private ownership.
Operator of closed landfill	Fingal County Council has operated this site since the 1950s.
Proposed use post remedial works	The site owner intends to use the site as an open space which will consist of a multi-use games area, car park, pathways, a cycleway and associated infrastructure. Planning for this development (Planning Reference F19A/0196) was granted by Fingal County Council on 5 th March 2020.
Risk category of closed landfill:	Moderate risk (class B) due to <ul style="list-style-type: none"> Lateral migration of landfill gas.
Section 22 register number:	S22-02655
Grid Reference	723131 E and 760830 N
Application received:	28 th August 2020

¹ Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008).

AA screening determination:	29 th September 2020
Regulation 7(4) notice:	2 nd November 2020
Additional information received:	Regulation 7(4) Reply received on 23 rd November 2020. Unsolicited information received on the following dates: <ul style="list-style-type: none"> - 9th October 2020 (two pieces of unsolicited information were received on this date); - 16th October 2020; - 20th October 2020, and - 23rd October 2020.
Name of Qualified Person:	Gareth McElhinney, RPS Consulting Engineers Limited. Credentials provided by Engineers Ireland.
EPA site inspection:	No inspection was required.

2. Information on the closed landfill

Location of facility	The closed landfill is located in a former sand and gravel pit in Barnageeragh Cove area to the north-west of the town of Skerries, County Dublin. The location of the landfill site is shown in Figure 1.
Period of landfilling	1950s to 1983.
Surrounding area	There are houses immediately adjacent to the site, as shown in Figure 2. From the east and north, the site is surrounded by an unnamed stream referred to by the applicant as Eastern stream or drain. To the north of the site runs the Barnageeragh Road and to the east of the site is an Irish Water waste water treatment plant (WWTP) which serves the Balbriggan Skerries Agglomeration (Licence Register No. D0023-01). Along the southern site boundary lies the Dublin-Belfast railway line. To the south from this railway are agricultural fields. Immediately to the west of the site is a cairn/burial mound (DU005:017).
Area of the closed landfill	The site covers an area of 1.4 ha.
Quantity of waste at the facility	Approximately 44,516 tonnes. (29,677m ³)
Characterisation of waste deposited	The applicant divides the site into Area 1 and Area 2, as circled in Figure 2: <u>Area 1</u> This area is also referred to by the applicant as "the main landfill waste body" or the "waste area". Area 1 comprises of silt/clay mixed with waste such as plastic, glass, ceramics, ash, timber, red brick,

	<p>blocks and gravels. Hazardous waste was also deposited across the entire waste body in Area 1, as shown in Figure 3. The applicant classified this waste as soil and stones containing hazardous substances (LoW code¹: 17 05 03*). It is noted that waste is not deposited around the perimeter of Area 1.</p> <p>The applicant divides the waste body into two parts, as shown in Figure 3, and outlined below:</p> <ul style="list-style-type: none"> - the bigger part which is filled with largely municipal waste; and - the smaller part which is filled with largely mixed construction and demolition (C&D) waste with some municipal waste. <p><u>Area 2</u></p> <p>This area is referred to by the applicant as “made ground” and is located north of the waste body. It was used as a construction materials storage compound during construction of the neighbouring housing estates. The applicant states that Area 2 has been cleared of the materials stored therein and landscaped with clean soil from on-site activities.</p> <p>Area 2 was subject to sand and gravel extraction and deposition activities in the past. The applicant states that the total quantity of the material imported to and filled in Area 2 is unknown. The applicant further states that the material deposited in Area 2 is not considered to be waste or by-product and it is likely to have arisen from on-site activities from the 1950s through to the 1970s. However, site investigations indicate that some waste has been deposited in the area.</p> <p>The site investigations show that Area 2 is partially filled with 2m to 5.5m of sandy gravelly silt/clay with cobbles. The trial pit investigations show that C&D waste was also deposited at two locations in this area (trial pits TP39 and TP43). At TP39 wood fragments were encountered and in TP43 concrete and timber were encountered. It is noted that Figure 6 shows TP43 outside the site boundary, however the amended site boundary is shown in Figure 9.</p>
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3. Site investigations

<p>Current condition and appearance of closed landfill:</p>	<p>The extent of the waste body within Area 1 is 0.85 ha. The site is currently not used for any activity. There is a grassed area and a public road overlying the western part of the waste body, as shown in Figure 2.</p> <p>No odour or leachate seepages were observed during the site walkover on the 28th March 2019. There are trees and a hedgerow separating the site from the railway line and the WWTP. There is also an Irish Water foul sewer main going through the waste body. This sewer main transfers sewage from Balbriggan to the WWTP (Licence Register No.</p>
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¹ Waste Classification, List of Waste & Determining if Waste is Hazardous or Non-hazardous, applicable from 5th July 2018.

	<p>D0023-01). It is not anticipated that any issues should occur in the event repairs are required to this sewer main in the future, as repairs without excavation are possible for underground pipework. In the event excavation is required, the integrity of the landfill cap can be restored once complete.</p>
<p>Site investigations</p>	<p>The site investigations carried out as part of Tier 1, 2 and 3 assessments established the following facts:</p> <ul style="list-style-type: none"> • The waste body is covered with sand, gravel and clay; • The maximum depth of waste is estimated to be approximately 10.5m below ground level (bgl); • Rainwater infiltrates into the waste body; • Landfill leachate is being generated and impacting groundwater quality; • The landfill is contributing to a deterioration in groundwater quality; • Landfill gas is being generated and is migrating off-site.
<p>Monitoring and analysis of samples (water, gas, waste):</p>	<p>The following site investigations were carried out as part of Tier 1, 2 and 3 assessments:</p> <ul style="list-style-type: none"> • desktop study, including site walk-over which was carried out on 28th March 2019; • surface water quality (four monitoring locations in total. Two rounds of monitoring were carried out on 11th January 2018 and 15th June 2018); • soil sampling (50 trial pits were excavated between 31st May 2017 and 3rd June 2017, on 4th July 2017 and 11th August 2017); • groundwater monitoring (in total 35 groundwater samples were taken from 14 groundwater boreholes. Three rounds of monitoring were carried out. The first round was carried out on 27th June 2017 and 2nd August 2017. The second round was carried out on 15th November 2017. The third round was carried out on 24th May 2018); • groundwater level analysis (carried out between July 2017 and August 2018); • detailed quantitative risk assessment (DQRA) modelling to assess the potential impact on groundwater and surface water; • asbestos survey (carried out on soil samples taken during trial pitting investigation. Two topsoil samples and forty soil samples were screened for asbestos. The screening did not indicate the presence of asbestos fibres in any of the samples); • pumping test to determine the hydraulic conductivity of the aquifer (carried out on 30th January 2018 and between 31st May 2018 and 1st June 2018); • leachate sampling (analysis of leachate was carried out on soil samples. 40 samples were obtained. The sampling was carried out on 21st February 2018);

	<ul style="list-style-type: none"> • geophysical survey (carried out on 24th November 2017 and 29th January 2018); • landfill gas monitoring (14 gas monitoring boreholes in total between June 2017 and January 2019. Additionally, 4 shallow gas wells were monitored in June 2017 and on 14th February 2018. Also, gas sampling was carried out on the underground services of the adjacent houses on 29th May 2018 and 5th June 2018 and an indoor gas survey was conducted in the houses on 15th December 2017. Additionally, a landfill gas probe survey was carried out at the interface of the foul rising main and waste body on 15th March 2018 and at the WWPT on 27th November 2018).
Hydrology	<p>The closed landfill is located within the Nanny-Delvin catchment (Catchment Identification Number: 08).</p> <p>There is an unnamed stream that flows near the site, from the southwest. Approximately 90m south-east of the closed landfill this stream splits into two and flows towards the site and towards the east. The water that flows towards the site forms a stream that is referred to by the applicant as Eastern stream or drain. This stream flows along the eastern and northern site boundary, as shown in Figure 4. Depending on the season and fluctuating groundwater table, the stream is either filled with water or dry. The water that flows towards the east forms the Barnageeragh Stream (waterbody code: IE_EA_08M030500), as shown in Figure 4.</p> <p>The Barnageeragh Stream ultimately discharges into the Mill Stream (Skerries) (waterbody code: IE_EA_08M030500), 2km downstream of the closed landfill. The Mill Stream discharges into the Irish Sea 3.3km downstream of the site. The Barnageeragh Stream or the Mill Stream have no WFD status assigned to them but the Water Framework Directive (WFD) status of the sea where the Mill Stream discharges is High.</p> <p>Two rounds of surface water monitoring were carried out on the Eastern stream on 11th January 2018 and 15th June 2018. The monitoring was conducted at locations SW1, SW2, SW3 and SW4, as shown in Figure 4. The upstream monitoring locations are SW1 and SW4 and the downstream monitoring locations are SW2 and SW3. The applicant states that, due to the low flow, no monitoring at the downstream locations was carried out in June 2018.</p> <p>The below table refers to the monitoring carried out in January 2018 and shows parameters which exceeded environmental quality standards (EQS) set out in <i>European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended</i>, or limits set in <i>European Communities (Quality of Surface Water Intended for Abstraction of Drinking Water) Regulations, 1989</i>, or <i>European Communities (Drinking Water) (No. 2) Regulations 2007</i>.</p>

	Parameter	EQS ¹ / Limit	Upstream Location SW1	Downstream location SW3
	Ammoniacal nitrogen [mg/l]	0.140 ¹	0.26	0.23
	Fluoride mg/l	1 ²	< 0.050	3.0
	Molybdate Reactive Phosphate as P [mg/l]	0.075 ¹	0.1	<0.05
	Iron [µg/l]	200 ³	230.0	230.0
	Total coliforms [cfu/100ml]	0 ³	142.1	13.5
	Faecal coliforms [cfu/100ml]	0 ³	34.0	2.0
	<p>The monitoring results show that fluoride concentration at the downstream location SW3 is 60 times higher than the concentration of this parameter at the upstream location SW1.</p> <p>Although concentrations for sulphate, magnesium, boron and selenium did not exceed the relevant limits, hence these parameters are not listed in the above table, their downstream concentrations were also higher than the upstream concentrations.</p> <p>The increase in the downstream concentrations of parameters indicates that the closed landfill impacts on surface water quality downstream of the site. 'Tier 2 & Tier 3 Environmental Risk Assessment' Report (here after referred to as 'The risk assessment') states that there is hydraulic connectivity between groundwater and surface water and that there is a pathway for leachate contamination to leach from the waste body into groundwater and thereby into surface waters.</p> <p>The monitoring results also show exceedances of parameters upstream of the closed landfill. This indicates that surface water quality is also impacted by factors other than the landfill, such as agriculture.</p> <p>Condition 3.9(d) requires monitoring of surface water upstream and downstream of the closed landfill on a quarterly basis. This condition also specifically requires monitoring for Total Ammonia, Fluoride, Iron, Coliforms and other relevant parameters.</p>			
Hydrogeology	<p>The closed landfill lies within the Balrothery Groundwater Body (GWB Number: IE_EA_G_043). The status of this groundwater body is good. The site is underlain by a poor aquifer in bedrock which is generally unproductive except for local zones (PI). The aquifer vulnerability beneath the site is High. Groundwater beneath the site flows towards the east, east/ north-east and east/ south-east as shown in Figure 5. From October to May the groundwater flowing beneath the waste body</p>			

¹ Environmental Quality Standard (EQS); 95% good status; as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

² Limit set in European Communities (Quality of Surface Water Intended for Abstraction of Drinking Water) Regulations, 1989 (S.I. 294 of 1989).

³ European Communities (Drinking Water) (No. 2) Regulations 2007 (S.I. 278 of 2007).

	<p>has a higher water table than during other times of the year and discharges into the Eastern boundary stream. From June to September the groundwater flowing beneath the waste body passes beneath the Eastern boundary stream and continues eastwards to discharge at the Barnageeragh Stream to the east of the WWTP.</p> <p>There are no drinking water wells/boreholes to the east of the closed landfill. There is a public water supply (borehole identification number: 3225SWW033) 2.3km south-west of the site in the townland of Loughbarn. This supply is the nearest drinking water supply to the closed landfill. Due to the fact that groundwater beneath the site flows in the opposite direction, there will be no impact on the water quality in this public water supply.</p> <p>There are also three private water boreholes and a holy well in the vicinity of the site. One of the boreholes is located 2.7km south of the site and the remaining two boreholes are located 2.6km and 2.7km to the south/ south-east of the site. The holy well, called Kibe Well, is located 2.3km south-east of the site in the townland of Townparks (Skerries). Due to the fact that groundwater beneath the site flows towards the east, east/ north-east and east/ south-east there will be no impact on the water quality in these boreholes or the holy well.</p> <p>The appropriate capping of the landfill will limit ingress of rain water into the waste body thus limiting the generation of leachate. Condition 3.9(e) requires monitoring of groundwater quality upgradient and downgradient of the waste body and specifies the parameters to be monitored.</p>
<p>Leachate and water quality:</p>	<p>The risk assessment states that groundwater quality beneath the waste body is characterised by elevated concentrations of ammonia, nitrite, chloride, sulphate, potassium, sodium, calcium, selenium, magnesium and other metals and the general absence of organic compounds. Area 2 is characterised by the presence of the same suite of chemical parameters but at lower concentrations.</p> <p><u>Leachate</u></p> <p>Soil samples were obtained from trial pits within the waste body in Area 1 and the made ground in Area 2, as shown in Figure 6. The concentrations of the sampled parameters were compared against the <i>Waste Acceptance Criteria set out in Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC</i>. The sampling results show that leachate is typical of leachate generated in a non-hazardous landfill with the exception of ten soil samples within Area 1 that returned a hazardous classification. The applicant assigned a waste code of 17 05 03* for these samples: soil and stones containing hazardous substances¹. The trial pits where hazardous waste was found are TP4, TP5, TP8, TP10, TP11, TP14, TP15, TP20, TP22 and TP23, as shown in Figure 3. Condition 3.1(e) requires installation of at least five leachate monitoring boreholes, of</p>

¹ Waste Classification, List of Waste & Determining if Waste is Hazardous or Non-hazardous, applicable from 5th July 2018.

which three shall be within the deposited waste in Area 1 and two of which shall be within the made ground in Area 2. Condition 3.9(b) requires leachate monitoring in these boreholes on a quarterly basis.

Water quality

Groundwater monitoring was carried out on 27th June 2017, 2nd August 2017, 15th November 2017 and 24th May 2018. The following boreholes were monitored, as shown in Figure 6:

- Area 1: boreholes BH1, BH2, BH3, BH17; and
- Area 2: boreholes BH4, BH8, BH9, BH10, BH11, BH12, BH13, BH14, BH15, BH16.

Borehole BH2 is located within Area 1 at the western edge of the waste body and is considered by the applicant to represent upgradient groundwater condition. Borehole BH17 is located within Area 1 at the eastern edge of the waste body and is considered by the applicant to represent downgradient groundwater condition. Other boreholes considered by the applicant to represent downgradient groundwater condition are boreholes BH10, BH11, BH12 and BH15, all of which are located in Area 2.

The table below shows the monitoring locations where elevated parameters were recorded.

Parameter	EQS/ IGV	Upgradient location (BH2)	Location within the waste body (BH1/ BH3)	Downgradient location (BH11/ BH12)
Electrical conductivity [mg/l]	1,875 ¹	720	7800 (BH1)	2,600 (BH11)
Total dissolved solids [mg/l]	1,000 ²	430	4,700 (BH1)	1,600 (BH11)
Ammoniacal Nitrogen [mg/l]	0.175 ¹	0.59	10.0 (BH1)	23 (BH11)
Chloride [mg/l]	187.5 ¹	40	1300 (BH1)	180 (BH11)
Sulphate [mg/l]	187.5 ¹	64	2,400 (BH1)	430 (BH11)
Potassium [mg/l]	5 ²	6.5	510 (BH1)	120 (BH11)
Sodium [mg/l]	150 ¹	25	570 (BH1)	140 (BH11)
Calcium [mg/l]	200 ²	190	360 (BH1)	400 (BH11)
Magnesium [mg/l]	50 ²	33	410 (BH1)	130 (BH11)

¹ European Union Environmental Objectives (Groundwater) Regulations 2010, as amended.

² As set out in the EPA publication 'Towards setting guideline values for the protection of groundwater in Ireland – Interim Report', 2003.

Aluminium [$\mu\text{g/l}$]	150 ¹	<10	17 (BH1)	160 (BH12)
Boron [$\mu\text{g/l}$]	750 ¹	160	3,300 (BH1)	760 (BH11)
Iron [$\mu\text{g/l}$]	200 ²	190	590 (BH1)	500 (BH12)
Manganese [$\mu\text{g/l}$]	50 ²	38	2,100 (BH1)	1,700 (BH11)
Mercury [$\mu\text{g/l}$]	0.75 ¹	<0.50	<0.50 (BH1)	0.83 (BH11)
Total Coliforms [cfu/100ml]	0 ¹	2	52.9 (BH3)	47.4 (BH15)

The above monitoring results show that the landfill leachate is impacting groundwater quality. For example, the concentrations of ammoniacal nitrogen, aluminium and mercury at the downgradient monitoring locations exceed the concentrations of these parameters at the upgradient location.

The exceedances of parameters at the upgradient monitoring location may indicate that groundwater quality is also impacted by factors other than the landfill, however the observed increase in the parameter concentrations at the downgradient locations indicates that the closed landfill is also impacting on groundwater quality.

Condition 3.9(e) requires monitoring on a quarterly basis of groundwater from at least three groundwater monitoring boreholes, one of which shall be upgradient of the waste body and two of which shall be downgradient of the waste body. This condition also specifically requires monitoring for electrical conductivity, total dissolved solids, ammonium, chloride, sulphate, potassium, sodium, calcium, magnesium, aluminium, boron, iron, manganese, mercury, coliforms and other relevant parameters. Additionally, Condition 3.9(b) requires quarterly monitoring for leachate.

Landfill gas:	<p>There is a risk of landfill gas migration to off-site buildings. The most likely pathway for the migration of the landfill gas is through the underlying bedrock and existing landfill cover.</p> <p>Gas monitoring was carried out at boreholes BH1-BH17 and at four shallow gas wells GS01, GS02, GS03 and GS04, as shown in Figure 6. The monitored parameters were methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2), hydrogen sulphide (H_2S) and volatile organic compounds (VOC). Also, gas flow rate was measured. Additionally, a landfill gas probe survey was carried out at the interface of the foul main and the waste body.</p> <p>Gas sampling was also carried out on the underground services of adjacent houses. Locations where stagnant gases were likely to accumulate were tested. The radon sump of each residence was also opened to see if a build-up of landfill gas was present within the</p>
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¹ European Union (Drinking Water) Regulations 2014, as amended.

foundations. Furthermore, an indoor gas survey was carried out and volatile organic carbon levels were assessed within the radon sump of the houses. Also, the water mains at the front of the houses were tested. Monitoring results are discussed further below.

The applicant also installed five passive gas vents (GV1, GV2, GV3, GV4 and GV5) within the waste body, as shown in Figure 6, to enable safe venting of gas into the atmosphere.

The below table shows the maximum concentrations of methane and carbon dioxide measured at on-site locations shown in Figure 6, post installation of the passive gas vents. For ease of reading, the monitoring locations outside the waste body are highlighted orange.

Borehole symbol	Location description	Methane (v/v %)	Carbon dioxide (% v/v)
GS01	Outside the waste body, immediately opposite the adjacent houses	0.8	4.5
GS02	Outside the waste body, immediately opposite the adjacent houses	0.3	2.5
GS03	Outside the waste body, immediately opposite the adjacent houses	0.3	0.7
GS04	Outside the waste body, immediately opposite the adjacent houses	0.3	0.3
BH1	The waste body near the railway tracks	7.4	11.5
BH2	The waste body at the western site boundary	0.2	3.9
BH3	The waste body near the houses	0.2	4.5
BH4	Area 2, just outside the waste body	73.6	20.9
BH5	The waste body near the houses	0.2	3.3
BH6	In the centre of the waste body	3.9	11.6
BH7	The waste body near the south eastern site boundary	11.9	13.3
BH8	Area 2, close to the waste body	0.8	6.6
BH9	Area 2, close to the waste body	4.7	8.8
BH10	Area 2, close to the waste body	0.3	13.7
BH11	Area 2, close to the waste body	5.8	14.8

BH12	Area 2, close to the waste body	8.4	14.7
BH13	Approximately in the centre of Area 2	0.3	6.7
BH14	Area 2, adjacent to the northern site boundary	0.3	6.6
BH15	Area 2, near the north-eastern corner of the site	0.4	15.1
BH16	Area 2, adjacent to the eastern site boundary	0.3	12.4
BH17	The waste body near the south-eastern site boundary	17.8	18.1

The monitoring results show that landfill gas is being generated within the waste body. The monitoring results also show that gas migrates outside the waste body from within Area 1 and Area 2 of the site. The monitoring results for the above locations show also that maximum gas flow varied from 0.2 l/h at a few locations to 0.6 l/h at borehole BH1.

As set out in the Agency Landfill Manuals - Landfill Monitoring, 2nd Edition, 2003, the trigger levels for emissions of methane and carbon dioxide in boreholes outside the waste body are, respectively, 1% v/v or greater and 1.5% v/v or greater. The monitoring results show that these trigger levels are significantly exceeded at a number of monitoring locations.

It is also noted that no gas monitoring took place near house No. 24 which is located immediately adjacent to Area 2, as shown in Figure 6. Having regard to the fact that landfill gas was detected within Area 2, it is considered appropriate to monitor gas at this house. Accordingly, Condition 3.1(d)(i) requires installation, within Area 2, of one gas monitoring borehole (GS05) near house No. 24.

Additionally, it is noted that no gas monitoring took place between Area 1 and house No. 52. Accordingly, Condition 3.1(d)(ii) requires installation of one gas monitoring borehole (GS06) near house No. 52.

The gas monitoring of the adjacent 23 houses shows that landfill gas was detected either in a radon sump or water mains meter of each house. Methane concentrations varied from 0.1% v/v to 0.3% v/v. Carbon dioxide concentrations varied from 0.1% v/v to 1.5% v/v in house No. 25 which is the nearest house to the waste body. As set out in the Agency Manuals - Landfill Site Design, the occupational exposure limits for carbon dioxide are short term (15 minutes) 1.5% and long term (8 hours) 0.5% by volume in air.

Additionally, gas monitoring shows that the maximum concentration of carbon dioxide at the foul rising main near the WWTP was recorded at 2.8% v/v.

It is noted that, for purposes of determining risk from landfill gas, the applicant had regard to British Standard 'BS8485:2015+A1:2019 Code

	<p><i>of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings</i>’. The risk assessment states that consideration was given to the close proximity of the houses and the fact that the made ground covers most of the site. In conclusion, the risk assessment states that the hazard from methane and carbon dioxide is considered low. The risk assessment further states that the hazard from hydrogen sulphide is considered to be very low to negligible and the hazard from VOCs is considered to be very low. Overall, the risk assessment states that the landfill constitutes a low hazard potential.</p> <p>The applicant also states that landfill gas flow rates from the boreholes show that there is not enough pressure to displace balance gases and therefore the risk of migration of gas is very low. It is noted however, that once the waste body has been capped, as recommended in the risk assessment, the increased back-pressure caused by the cap may result in an increased lateral movement and flow of gas.</p> <p>Condition 3.1(b) requires a landfill cap, to include a 1mm thick low permeability geomembrane, and Condition 3.1(c) requires a passive gas venting system, as outlined below in Section Title: <i>Proposed Remedial Actions</i>. Condition 3.9(c) also requires monitoring to detect the presence and concentration of landfill gas on a quarterly basis.</p> <p>Furthermore, due to the fact the methane concentration was high at numerous locations within the site with the maximum concentration recorded at 73.6 % v/v at borehole BH4 in Area 2, which is outside the waste body, Condition 3.1(g) requires that the applicant seeks the Agency’s agreement whether to carry out a gas pumping trial within twelve months if the applicant wishes to assess the feasibility of utilising the landfill gas.</p> <p>Additionally, Condition 3.1(i) requires that the local authority ensures that recommendations in the guidance given in the Department of Environment 1994 publication “Protection of New Buildings and Occupants from Landfill Gas” and any subsequent revisions have been considered and applied to any future buildings within the closed landfill.</p>
<p>Conceptual site model:</p>	<p>Tier 1 Assessment determined that the overall risk score for the closed landfill is Moderate (Class B) due to the lateral gas migration (SPR 10) and vertical gas migration (SPR 11).</p> <p>Following Tier 2 and Tier 3 site investigations, this categorisation was revised and the risk scores for lateral and vertical gas migration were changed from Moderate to Low. This resulted in lowering the overall risk category of the landfill from Moderate Risk to Low Risk.</p> <p>Three components are specified in the Code of Practice¹ for purposes of establishing the risk score for gas migration. These are waste type, proximity of receptor (human presence) and type of subsoil/bedrock material through which landfill gas can migrate. The Code of Practice</p>

¹ EPA Code of Practice, Environmental Risk Assessment for Unregulated Waste Disposal Sites, 2007. Section 4.3.2.2 Landfill Gas Migration Pathway, Tables 2d and 2e.

	<p>specifies five types of such a material and each of them has an assigned matrix score.</p> <p>It is noted that the types of material through which landfill gas can migrate in the Tier 1 assessment risk scoring is "sand and gravel, made ground, urban, karst", while the revised scoring in the Tier 2 and Tier 3 assessments, classifies material through which landfill gas can migrate as "All other Tills (including limestone, sandstone etc. – moderate permeability)", based on the assumption of a moderate permeability for the site. The change of the material type and associated score resulted in lowering the risk category for lateral and vertical gas migration from Moderate Risk to Low Risk.</p> <p>In support of this reclassification, the risk assessment states that the site investigations confirmed the presence of "made ground, fill and sand and gravel quaternary deposits" across the site. However, the risk assessment adds, the site is also covered in a layer of clay that is well compacted from site activities during the construction of the housing estate. The risk assessment further states that landfill gas flow rates show that there is not enough pressure to displace balance gases and therefore the risk of migration is very low and for this reason this pathway matrix has been downgraded.</p> <p>The above gas monitoring results show however, that the existing material on-site enables landfill gas migration within the entire site and to off-site locations, such as the adjacent houses and WWTP. It is also considered that as there is made ground, fill material and sand and gravel on site, the description of the "All other Tills (including limestone, sandstone etc. – moderate permeability)" is not fully reflective of the type and permeability of the actual material on site. Furthermore, as stated above, the lateral movement and flow of gas may increase as a result of the installation of the landfill cap.</p> <p>Accordingly, it is considered that the Moderate Risk scoring for lateral and vertical gas migration, as stated in Tier 1 assessment, is reflective of the actual conditions on site. It is therefore recommended that the risk category of the landfill remains as Moderate Risk (Class B) due to the risk for lateral and vertical gas migration.</p> <p>The conceptual site model for the site prior to mitigation measures is shown in Figure 7.</p> <p>It is noted that although a label that reads "Landfill gas migration from waste body to adjacent residencies, off-site commercial property & WWTP to East" has been crossed out in this figure, the site investigations, as outlined above, show that landfill gas migrates from the waste body to the off-site locations such as the adjacent houses.</p>
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4. SPR linkages and remedial actions

<p>SPR linkage scenarios (applicable ones only):</p>	<p>Leachate and gas migration scores:</p> <p><u>High scores:</u></p> <p>No pathways were identified as High Risk.</p>
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	<p><u>Moderate scores:</u></p> <p>Two pathways were identified as Moderate Risk:</p> <ul style="list-style-type: none"> • Human health exposure pathway of off-site lateral migration of landfill gas into nearby buildings (SPR 10); and • Vertical landfill gas migration (SPR 11). <p><u>Low scores:</u></p> <p>Five pathways were identified in Tier 2 Assessment as Low Risk:</p> <ul style="list-style-type: none"> • Migration of leachate, via groundwater flowing to water drainage/runoff, into to surface waterbodies (SPR 1); • Migration of leachate to private wells (SPR 3); • Migration of leachate to the underlying aquifer (SPR 5); • Migration of leachate to public water supplies (SPR 6); and • Migration of leachate, via groundwater migration, to surface water bodies (SPR 7). <p>Summary:</p> <p>Upon the review of the monitoring data;</p> <ul style="list-style-type: none"> • remedial action is warranted to address the risk of off-site migration of landfill gas. • remedial action is warranted to address the risk of leachate migrating from the site into groundwater and surface water bodies.
<p>Proposed remedial actions:</p>	<p>The applicant considered the following remedial measures as the feasible options:</p> <p><u>Area 1</u></p> <ul style="list-style-type: none"> • Regrading of the site to provide safe slopes for construction of the landfill capping system and future use of the land; • Installation of a "regulation layer" over the waste body to provide a smooth and safe surface on which the landfill capping layers can be placed. The risk assessment recommends that this layer is 300mm thick; • Installation of a gas drainage layer which comprises of a network of passive gas vents connected to a 6m high gas vent stack. The applicant stated that the gas vent stack will serve as the only gas emission point on the site once the landfill becomes a public area, as having gas vents across the site would pose issues in terms of maintenance and health & safety. <p>The applicant also stated that the gas vent stack has already been constructed and the gas vents have been connected to it via a gas collection pipe, as shown in Figure 8. It is noted however that Figure 8 shows that only four gas vents, from only one section of Area 1, are connected via the collection pipe to the vent stack.</p> <p>Due to the fact that landfill gas was detected in the monitoring locations within the entire site, and the recorded gas</p>

concentrations were elevated at numerous monitoring locations, it is considered that the installation of a gas venting system in only one section of the site is insufficient. Accordingly, Condition 3.1(c) requires the installation of a passive gas venting system within all of Area 1 where waste is deposited and in the made ground in Area 2 within six months of the date of grant of the Certificate of Authorisation. Additionally, the passive gas venting system must include locations outside of these areas where elevated gas concentrations were recorded (>1.0% methane, >1.5% carbon dioxide). It is also considered that additional gas vent stacks may be necessary due to the number of locations where gas was detected, accordingly Condition 3.1(c)(ii) provides for additional gas vent stacks if necessary. Additionally, Condition 3.5 requires an updated drawing showing the gas collection management system.

Furthermore, considering that landfill gas migrates from the waste body into Area 2 and to adjacent houses and the fact that methane in the landfill gas presents a fire or explosive threat, Condition 3.1(c)(iii) requires the installation of an engineered cut-off trench between the waste body and the houses adjacent to Area 1 (house No. 25 to 32) and, if required by the Agency based on gas monitoring results, between the waste body in Area 1 and house No. 52 and between the made ground in Area 2 and the houses along the western boundary of Area 2 (house No. 25 & house No. 24). Condition 3.1(c)(iii) further requires that the cut-off trench is filled with gravel and lined from the houses side with a high-density polyethylene (HDPE) liner. Condition 3.1(c)(iii) further requires that the base of the cut-off trench is constructed to the maximum depth of the deposited waste.

- Installation of a low permeability barrier layer (permeability to be less than or equal to 1×10^{-9} m/s) to cover part of the waste body in Area 1, as shown in Figure 9. The risk assessment recommends that the low permeability layer should be a geomembrane, such as 1mm linear low-density polyethylene (LLDPE).

Considering however the fact that hazardous waste was deposited in the waste body beneath the grassed area opposite the houses shown in Figure 2, the infiltration of rainwater into the waste body and the negative impact the waste body is having on groundwater, Condition 3.1(b) requires installation of an engineered landfill cap also over this grassed area.

- Installation of a surface water drainage geocomposite to intercept surface water and construction of surface water drains as shown in Figure 8. The risk assessment recommends that surface water drains are constructed around the perimeter of the capped area and discharge to the Eastern Stream at the north-eastern corner of the site.
- Placement of a minimum of 1m thick soil layer comprising 850mm of clean subsoil overlain by 150mm clean topsoil.

It is noted that planting shrubs and trees within Area 2 and a

part of Area 1 is proposed. The risk assessment states that where trees are likely to be planted in the soil layer, a minimum of 1.5m of soil will be placed to prevent damage to the geomembrane.

It is considered however, that there is potential for tree roots to damage the landfill cap even where a 1.5m deep soil layer is available. Therefore, Condition 3.16 requires that there shall be no planting of trees over the capped areas of the site. This condition does not prohibit the planting of shrubs.

Area 2

No landfill cap or other remediation measures, other than landscaping, are proposed for this area. The risk assessment states that it is not considered necessary to construct a landfill cap over this area.

Considering however that landfill gas was detected in Area 2 and the potential for the back-pressure from the landfill cap over Area 1 causing increase in gas movement and flow into Area 2, Condition 3.6 requires that, following gas monitoring for a period of twelve months, an engineered landfill cap is installed in Area 2 if required by the Agency.

Environmental Monitoring

The risk assessment recommends the following monitoring:

Surface water monitoring

Tier 3 Assessment recommends surface water monitoring on a quarterly basis at the existing monitoring locations SW1 (upstream of the closed landfill) and SW3 (downstream of the closed landfill).

Condition 3.9(d) reflects this recommendation and requires monitoring of surface water at these locations.

Groundwater monitoring

The risk assessment recommends quarterly groundwater monitoring at the existing upgradient monitoring location BH2 and existing downgradient monitoring locations BH10, BH11, BH12, BH15 and BH17.

Condition 3.9(e) requires monitoring of groundwater from at least three groundwater monitoring boreholes, one of which shall be located upgradient of the waste body and two of which shall be downgradient of the waste body.

Landfill gas monitoring

Tier 3 Assessment recommends gas monitoring on a biannual basis at the existing monitoring locations along the adjacent houses (monitoring locations GS01, GS02, GS03, GS04), boreholes within the main waste body (boreholes BH1, BH7 and BH17) and boreholes in Area 2 (boreholes BH4, BH12,

BH14 and BH16).

It is noted that the recommended monitoring does not include boreholes in the western part of the waste body or other boreholes shown in Figure 6. Therefore, in addition to the recommended monitoring from the Tier 3 Assessment, Condition 3.9(c) requires gas monitoring in the vent stack(s), BH15 and the proposed boreholes, GS05 and GS06, near house No. 24 and house No. 52 respectively. Additionally, Condition 3.1(d)(iii) requires installation of additional gas monitoring boreholes between the cut-off trenches and the adjacent houses to demonstrate the effectiveness of the cut-off trenches, if required by the Agency. Gas monitoring at these boreholes and at the existing infrastructure (radon sumps & water mains meters) of the adjacent houses No. 24 to 34 and house No. 52 is also provided for in Condition 3.9(c).

Also, having regard to some of the high concentrations of landfill gas recorded during the site investigations, it is considered that gas monitoring at a higher frequency, than biannually, is appropriate. Accordingly, Condition 3.9(c) requires quarterly monitoring to detect the presence and concentration of landfill gas. Furthermore, Condition 3.9(c) also requires that the applicant has regard to the Agency's Air Guidance (AG) Notes and Landfill Manual – Landfill Monitoring, 2nd Edition, 2003, when carrying out gas monitoring. Condition 3.10 permits amendment of the monitoring frequency with the agreement of the Agency following evaluation of test results.

Tier 3 Assessment recommends also that a visual assessment of the closed landfill is carried out annually. Condition 3.9(a) requires a visual inspection of the landfill on an annual basis.

Having regard to the monitoring results submitted in support of the application for CoA, the age of the closed landfill, the location of the nearest private well (2.3km south-west of the site) and the fact that the nearby housing estates are serviced by public supply water mains, the following remedial measures are considered appropriate and recommended in Condition 3.1:

- (a) Minimise the disturbance of deposited waste to the extent possible;
- (b) Install a low permeability landfill cap, minimum 1m, with 1mm thick low permeability geomembrane having a hydraulic conductivity of less than or equal to $1 \times 10^{-9} \text{m/s}$; The landfill cap shall be installed over the waste body, as shown on Drawing No. MGE0755-RPS-00-XX-DR-C-DG0001-02 (Revision F01 dated 13/11/20) titled 'Barnageeragh historical landfill site location map - contour map', and over the grassed area opposite houses No. 27 to No. 32.
- (c) Install passive gas venting system, in the following areas within six months of the date of grant of this Certificate of Authorisation:

- Area 1 where waste is deposited;
- In the made ground of Area 2; and
- Unless otherwise agreed by the Agency, any area outside of the above, where elevated gas concentrations were recorded in the Tier 2 Assessment (>1.0% methane, >1.5% carbon dioxide).

The passive gas venting system shall include the following elements:

- (i) gas vent pipes with cowls for gas extraction. The gas vent pipes shall not be perforated above the ground level;
- (ii) 6m high gas vent stack(s) and associated underground gas collection pipe(s);
- (iii) Gas cut-off trench in the following areas:
 - Between the waste body in Area 1 and houses No. 25 to No. 32 adjacent to Area 1;
 - If required by the Agency, following gas monitoring for a period of twelve months as required under Condition 3.9(c), between the waste body in Area 1 and house No. 52; and
 - If required by the Agency, following gas monitoring for a period of twelve months as required under Condition 3.9(c), between the made ground in Area 2 and houses No. 24 to No. 25.

The gas cut of trench shall include the following elements:

- The base of the gas cut-off trench shall be constructed at the maximum depth of the deposited waste; and
- The gas cut-off trench shall be filled with gravel and have a high-density polyethylene (HDPE) liner installed on the houses side of the gas cut-off trench, unless otherwise agreed by the Agency.

(d) Install the following gas monitoring boreholes:

- (i) One gas monitoring borehole (GS05) within Area 2 near house No. 24;
- (ii) One gas monitoring borehole (GS06) near house No. 52; and
- (iii) Additional gas monitoring boreholes between the gas cut-off trenches and the adjacent houses, if required by the Agency to assess the effectiveness of the trenches in preventing lateral gas migration.

(e) Install at least five leachate monitoring boreholes, of which three shall be located within the deposited waste in Area 1 and two of which shall be located within the made ground in Area 2;

	<p>(f) Reseed grass within the site;</p> <p>(g) The local authority shall, within twelve months of the date of grant of this Certificate of Authorisation, following gas monitoring, as required under Condition 3.9(c), seek agreement of the Agency regarding whether to carry out a gas pumping trial for the purpose of determining the quantity and quality of landfill gas;</p> <p>(h) Upon any agreement obtained in accordance with Condition 3.1(g), the local authority shall submit details of the proposed gas pumping trial for agreement by the Agency, and implement any recommendations arising therefrom; and</p> <p>(i) Ensure that recommendations in the guidance given in the Department of Environment 1994 publication "Protection of New Buildings and Occupants from Landfill Gas" and any subsequent revisions have been considered and applied to any future buildings within the closed landfill.</p> <p>The proposed remedial actions are intended to break the SPR linkages by preventing:</p> <ul style="list-style-type: none"> • migration of leachate into the aquifer and surface water bodies; and • migration of landfill gas to the adjacent houses and other off-site locations. <p>The proposed capping will also prevent any waste materials from appearing on the surface of the landfill site.</p> <p>The recommended certificate of authorisation allows for the importation and use of soil and stone to complete the works.</p>
<p>Proposed aftercare monitoring and assessment:</p>	<p>Monitoring as specified in Condition 3.9 of the recommended certificate of authorisation.</p> <p>Validation report to be submitted within 30 months.</p>
<p>Adequacy of risk assessment:</p>	<p>Regulation 7(7) of the Regulations states that the EPA must be satisfied with the risk assessment before proposing to grant a certificate of authorisation. The risk assessment is adequate as it has identified, assessed and adequately addressed the associated risks inherent with the landfill site.</p>

5. Appropriate assessment

There are twelve European Sites within the vicinity of the facility. These are listed in Appendix 1.

A screening for Appropriate Assessment was undertaken to assess, in view of best scientific knowledge and the conservation objectives of the site, if the activity, individually or in combination with other plans or projects is likely to have a significant effect on any European Site. In this context, particular attention was paid to the European Sites at Skerries Islands SPA (Site code: 004122), Rockabill to Dalkey Island SAC (Site code:

003000), Rockabill SPA (Site code: 004014), River Nanny Estuary and Shore SPA (Site code: 004158), Boyne Coast and Estuary SAC (Site code: 001957), Boyne Estuary SPA (Site code: 004080), Lambay Island SAC (Site code: 000204), Lambay Island SPA (Site code: 004069), Rogerstown Estuary SAC (Site code: 000208), Rogerstown Estuary SPA (Site code: 004015), Malahide Estuary SAC (Site code: 000205) and Malahide Estuary SPA (Site code: 004025).

The activity is not directly connected with or necessary to the management of any European Site and the Agency considered, for the reasons set out below, that it cannot be excluded, on the basis of objective information, that the activity, individually or in combination with other plans or projects, will have a significant effect on any European Site and accordingly determined that an Appropriate Assessment of the activity was required.

The reason for this determination is as follows:

- 'Tier 2 & Tier 3 Environmental Risk Assessment' states that a significant component of the waste body is below the water table and that groundwater beneath the closed landfill discharges in an easterly direction towards:
 - (i) a drain which runs along the eastern site boundary and discharges into Irish Sea 650m downstream of the closed landfill. This drain is also referred to by the applicant as eastern boundary culverted stream/drain; and
 - (ii) the Barnageeragh Stream (waterbody code: IE_EA_08M030500), which ultimately discharges into Irish Sea, 3.3km downstream of the closed landfill.
- The above European Sites are located either in coastal waters of Irish Sea or transitional waterbodies.

Hence, there is a hydrological connection between the closed landfill and the above European Sites.

An Inspector's Appropriate Assessment has been completed and has determined, based on best scientific knowledge in the field and in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 as amended, pursuant to Article 6(3) of the Habitats Directive, that the activity, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site, in particular Skerries Islands SPA (Site code: 004122), Rockabill to Dalkey Island SAC (Site code: 003000), Rockabill SPA (Site code: 004014), River Nanny Estuary and Shore SPA (Site code: 004158), Boyne Coast and Estuary SAC (Site code: 001957), Boyne Estuary SPA (Site code: 004080), Lambay Island SAC (Site code: 000204), Lambay Island SPA (Site code: 004069), Rogerstown Estuary SAC (Site code: 000208), Rogerstown Estuary SPA (Site code: 004015), Malahide Estuary SAC (Site code: 000205) and Malahide Estuary SPA (Site code: 004025), having regard to their conservation objectives and will not affect the preservation of these sites at favourable conservation status if carried out in accordance with the application, risk assessment and recommended certificate of authorisation and the conditions attached hereto for the following reasons:

- specifically, the remedial works will be undertaken to minimise the potential for water pollution in Skerries Islands SPA (Site code: 004122), Rockabill to Dalkey Island SAC (Site code: 003000), Rockabill SPA (Site code: 004014), River Nanny Estuary and Shore SPA (Site code: 004158), Boyne Coast and Estuary SAC (Site code: 001957), Boyne Estuary SPA (Site code: 004080), Lambay Island SAC (Site code: 000204), Lambay Island SPA (Site code: 004069), Rogerstown Estuary SAC (Site code: 000208), Rogerstown Estuary SPA (Site code: 004015), Malahide Estuary SAC (Site code: 000205) and Malahide Estuary SPA (Site code: 004025) and will ensure that there will be no significant impact on these European Sites;

- the project alone, which consists of the remediation of the closed landfill, or in-combination with other projects, will not adversely affect the integrity, and conservation status of any of the qualifying interests of Skerries Islands SPA (Site code: 004122), Rockabill to Dalkey Island SAC (Site code: 003000), Rockabill SPA (Site code: 004014), River Nanny Estuary and Shore SPA (Site code: 004158), Boyne Coast and Estuary SAC (Site code: 001957), Boyne Estuary SPA (Site code: 004080), Lambay Island SAC (Site code: 000204), Lambay Island SPA (Site code: 004069), Rogerstown Estuary SAC (Site code: 000208), Rogerstown Estuary SPA (Site code: 004015), Malahide Estuary SAC (Site code: 000205) and Malahide Estuary SPA (Site code: 004025); and
- also, there are no significant emissions to air from the landfill which could affect the bird species that the Skerries Islands SPA (Site code: 004122), Rockabill SPA (Site code: 004014), River Nanny Estuary and Shore SPA (Site code: 004158), Boyne Estuary SPA (Site code: 004080), Lambay Island SPA (Site code: 004069), Rogerstown Estuary SPA (Site code: 004015) and Malahide Estuary SPA (Site code: 004025) are designated for.

In light of the foregoing reasons, no reasonable scientific doubt remains as to the absence of adverse effects on the integrity of those European Sites: Skerries Islands SPA (Site code: 004122), Rockabill to Dalkey Island SAC (Site code: 003000), Rockabill SPA (Site code: 004014), River Nanny Estuary and Shore SPA (Site code: 004158), Boyne Coast and Estuary SAC (Site code: 001957), Boyne Estuary SPA (Site code: 004080), Lambay Island SAC (Site code: 000204), Lambay Island SPA (Site code: 004069), Rogerstown Estuary SAC (Site code: 000208), Rogerstown Estuary SPA (Site code: 004015), Malahide Estuary SAC (Site code: 000205) and Malahide Estuary SPA (Site code: 004025).

6. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed



Ewa Babiarczyk

Date 29th March 2021

Procedural Note

Any representations received by the Agency within 30 days of the draft certificate of authorisation being made available will be considered by the Agency.

As soon as practicable after the expiry of the 30-day period the Agency will determine the certificate of authorisation, which may vary from the draft certificate, and shall issue an appropriately validated certificate of authorisation in accordance with the Waste Management (Certificate of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008.

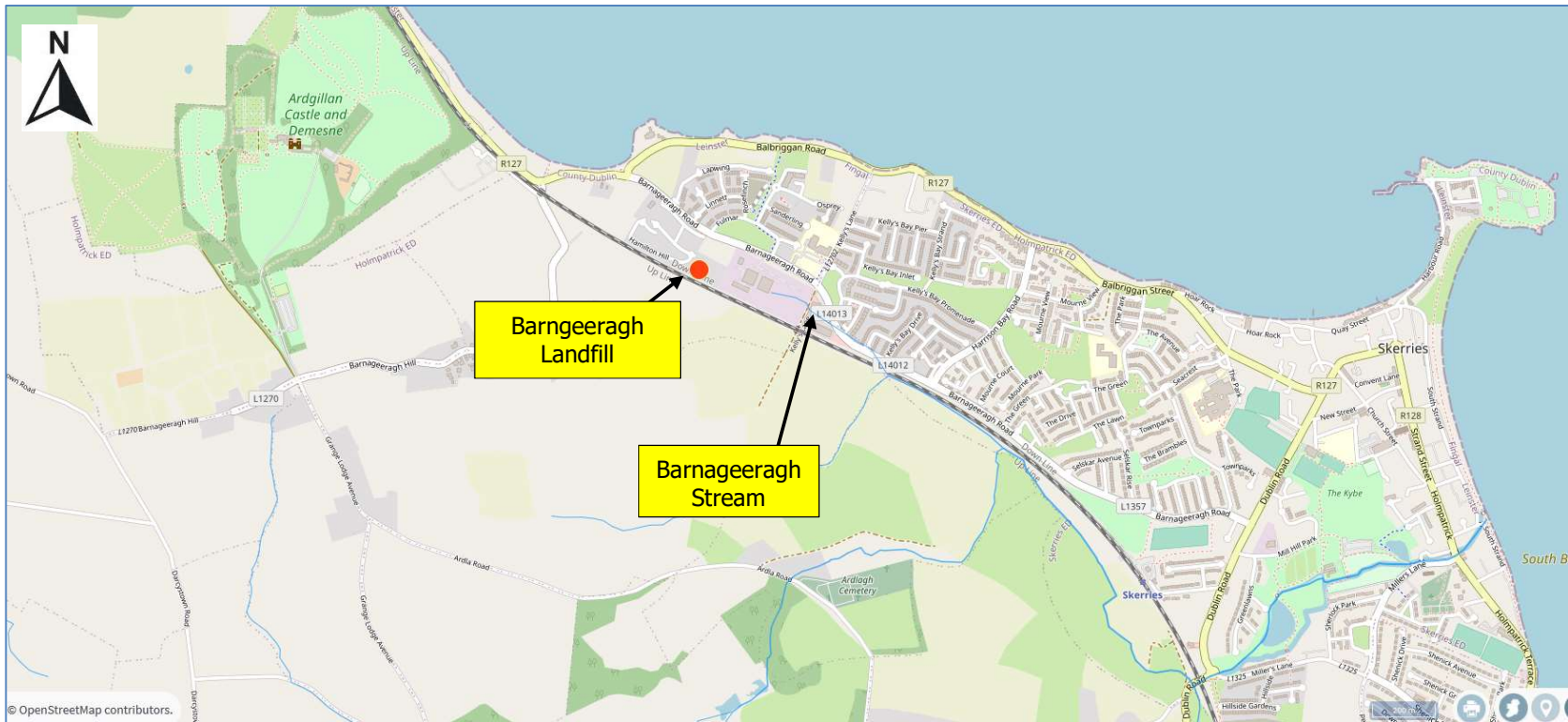


Figure 1: Location of Barnageeragh Landfill

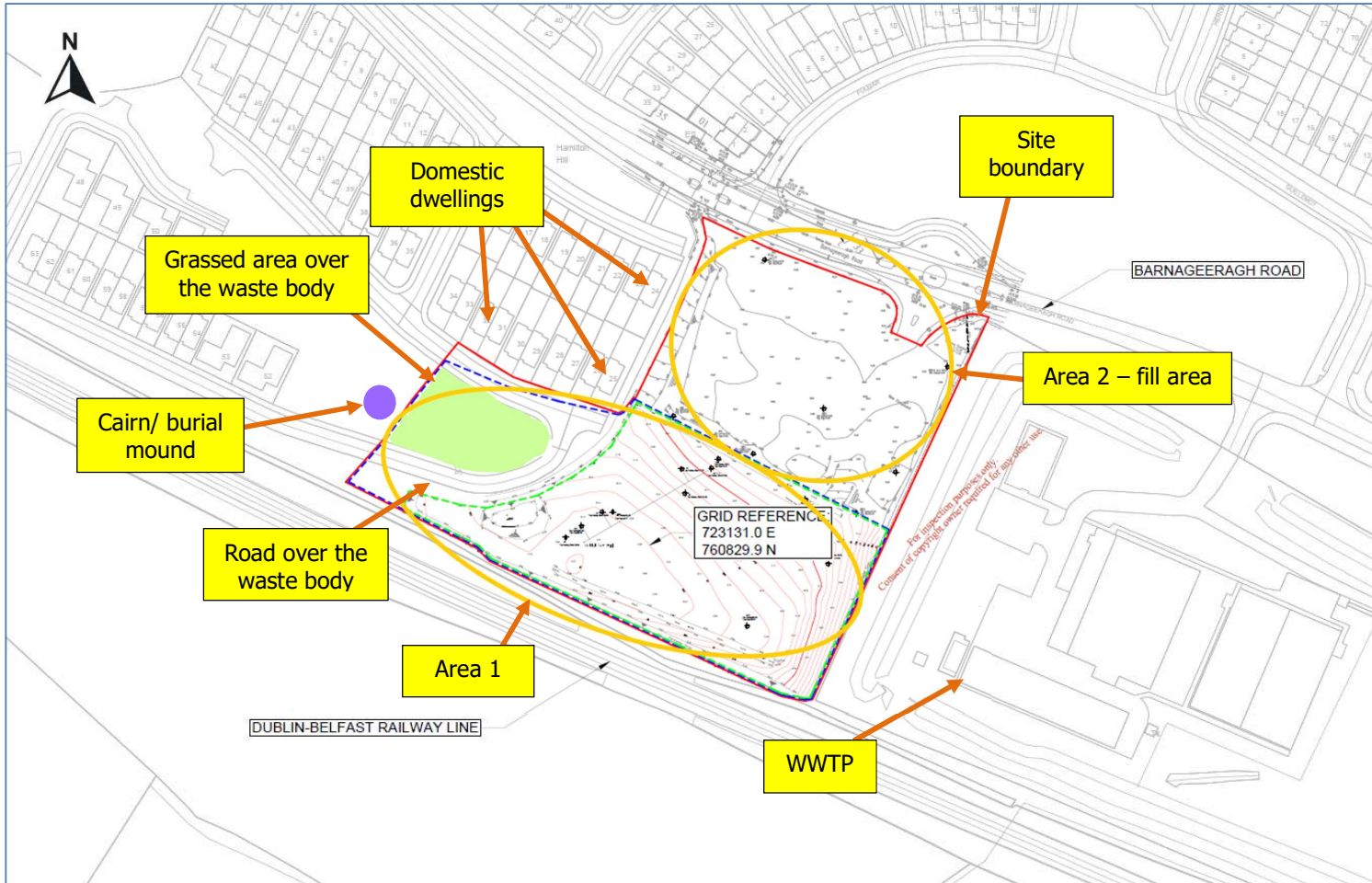


Figure 2: Site layout and site surroundings

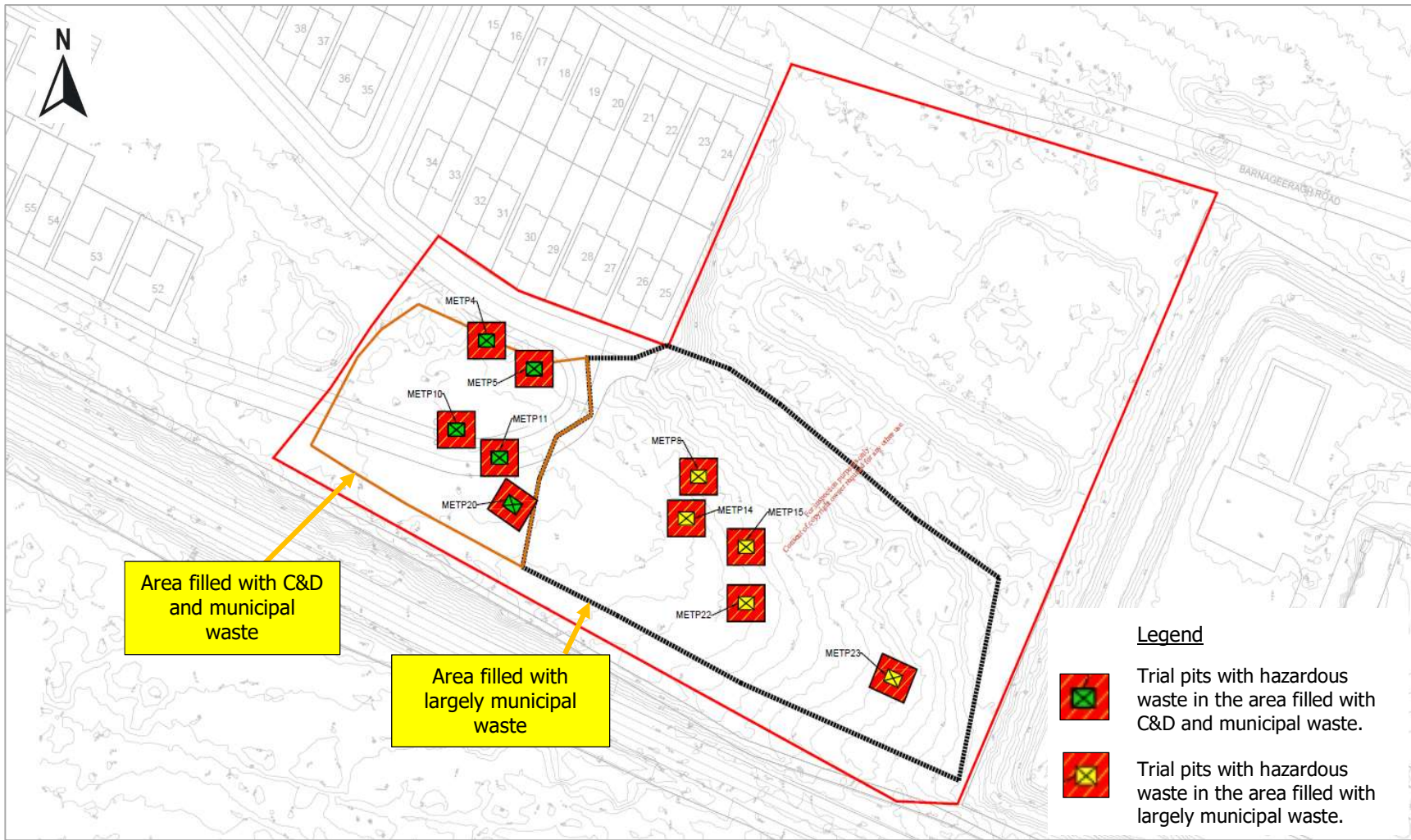


Figure 3: Extent of deposited waste and location of hazardous waste

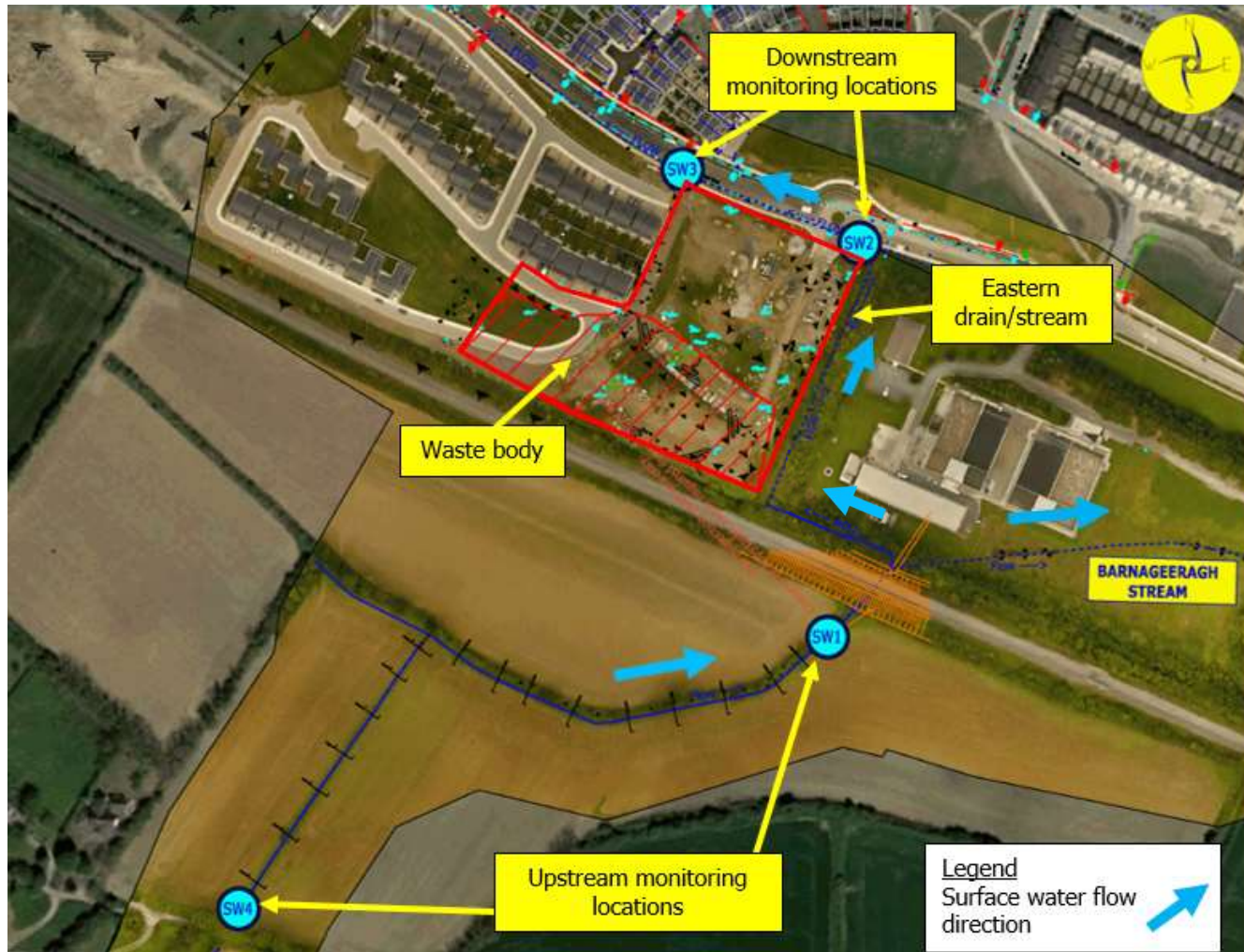


Figure 4: Surface water monitoring locations

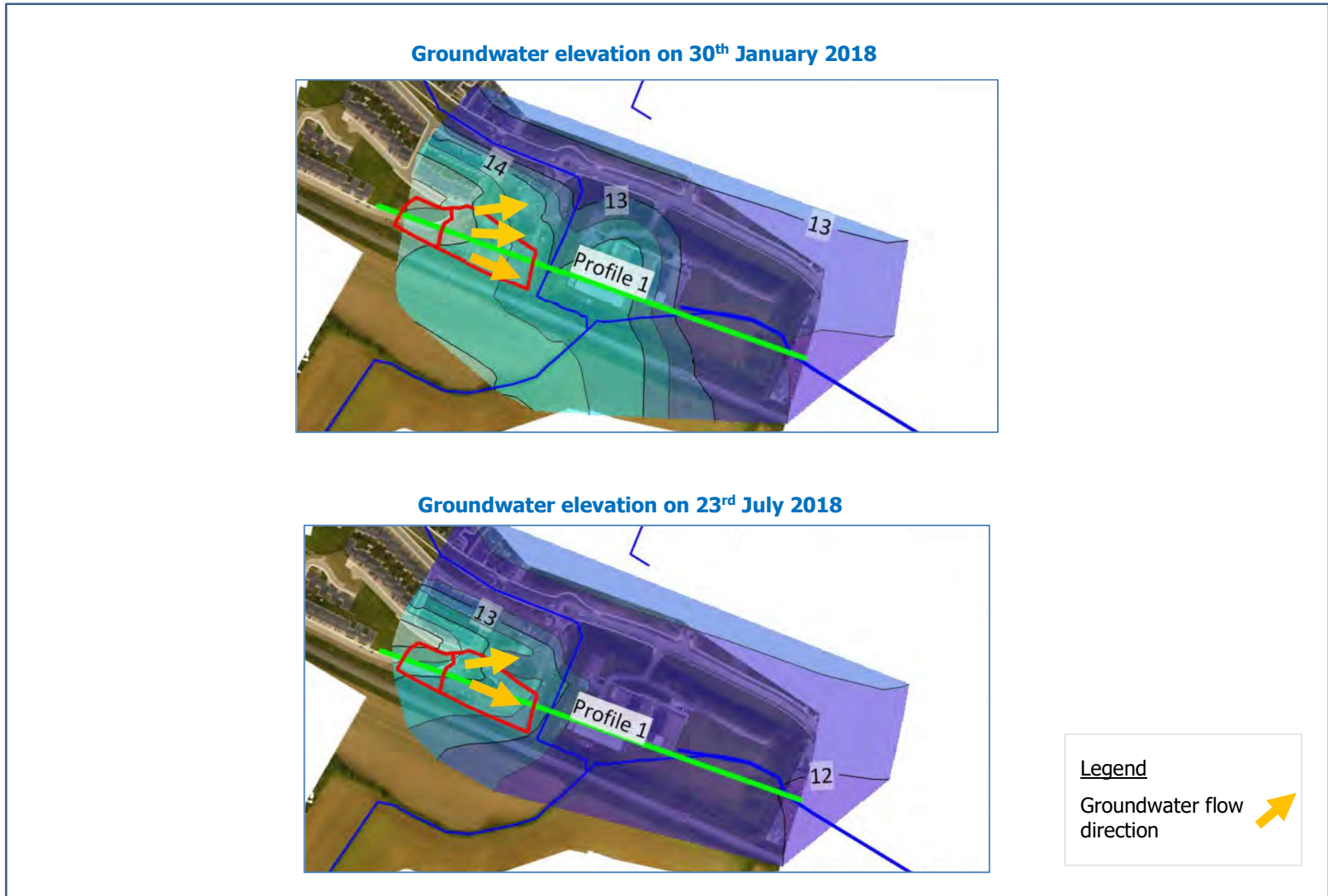


Figure 5: Groundwater flow directions

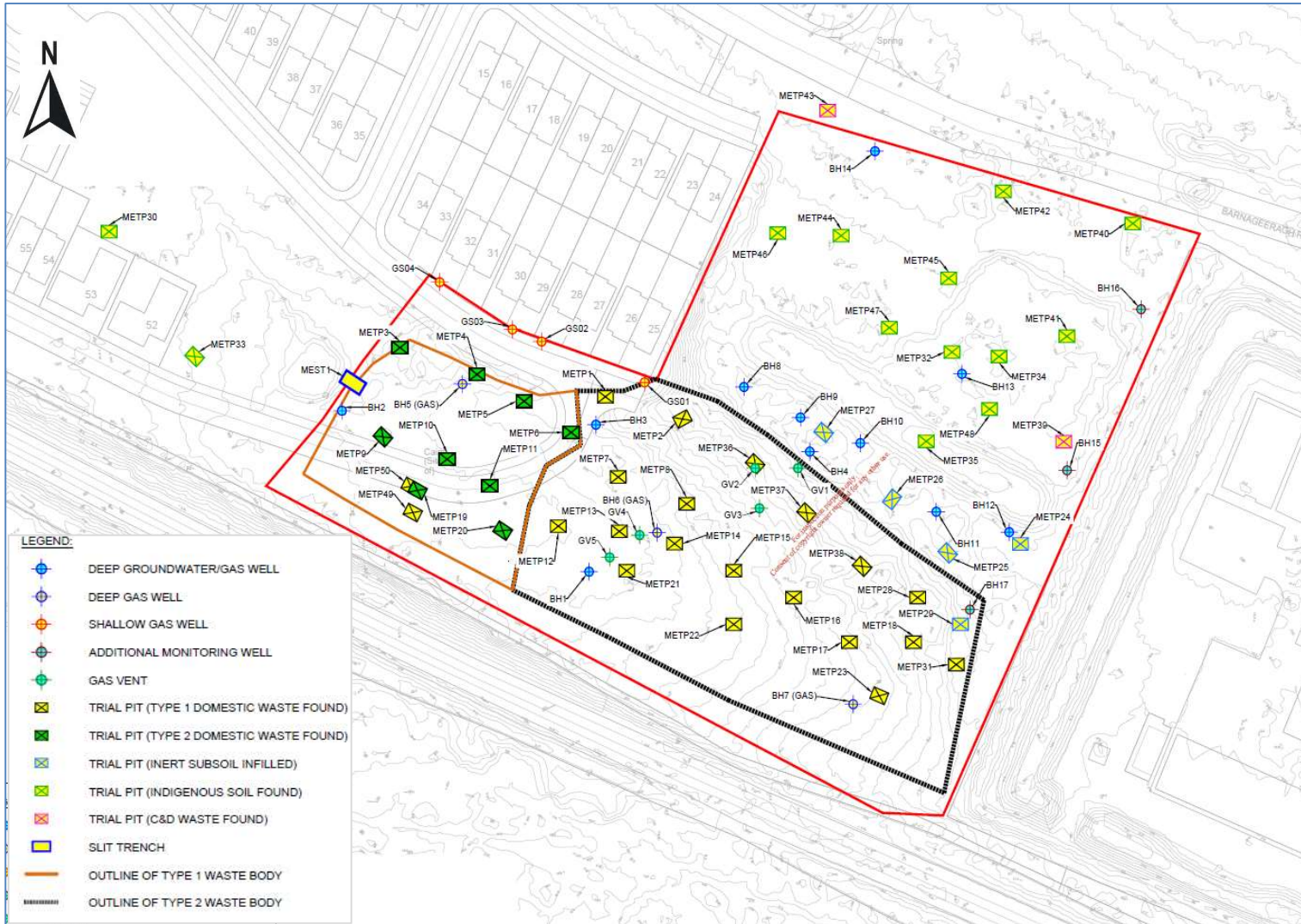


Figure 6: Trial pit (METP), groundwater/gas monitoring borehole (BH), gas vent (GV) and shallow gas well (GS) monitoring locations

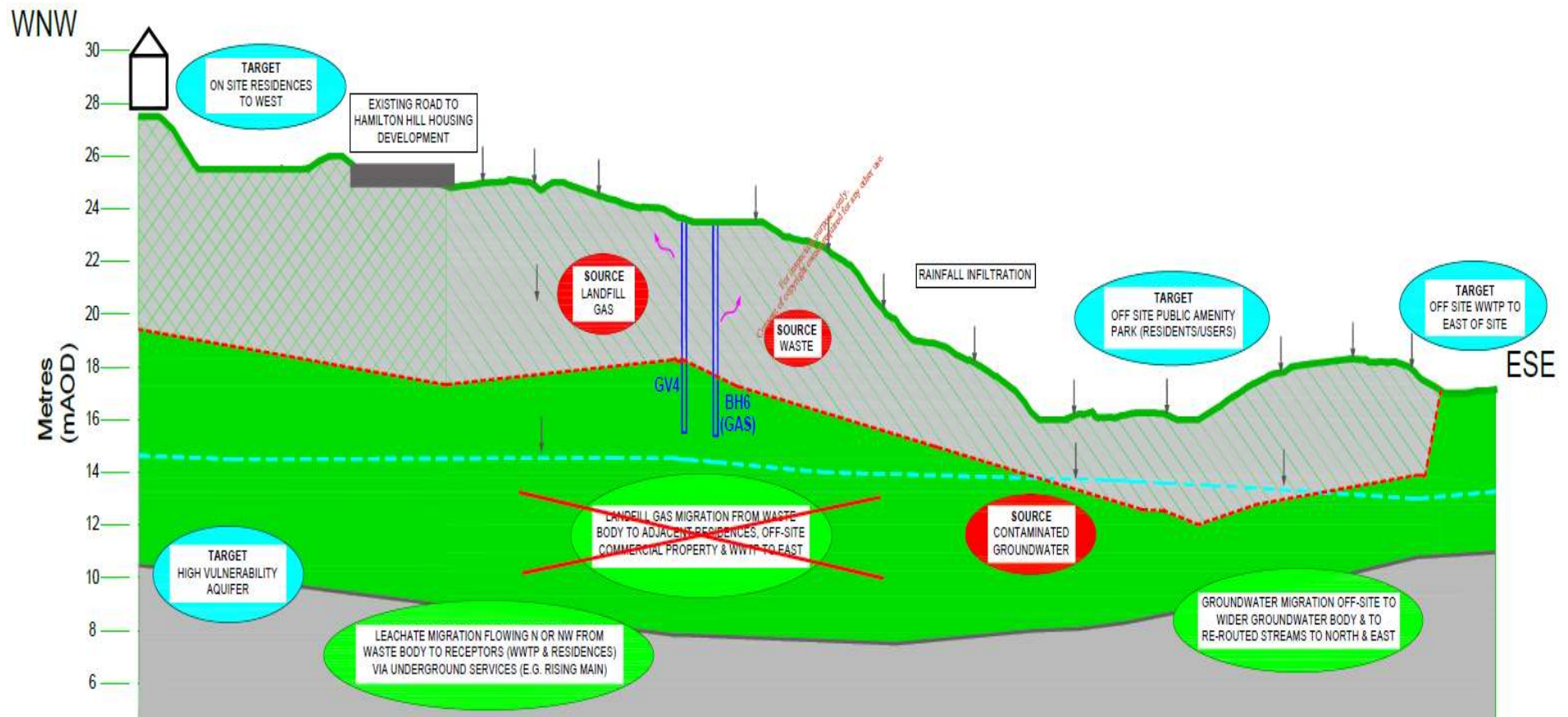


Figure 7: Conceptual site model for Barnageeragh Landfill site

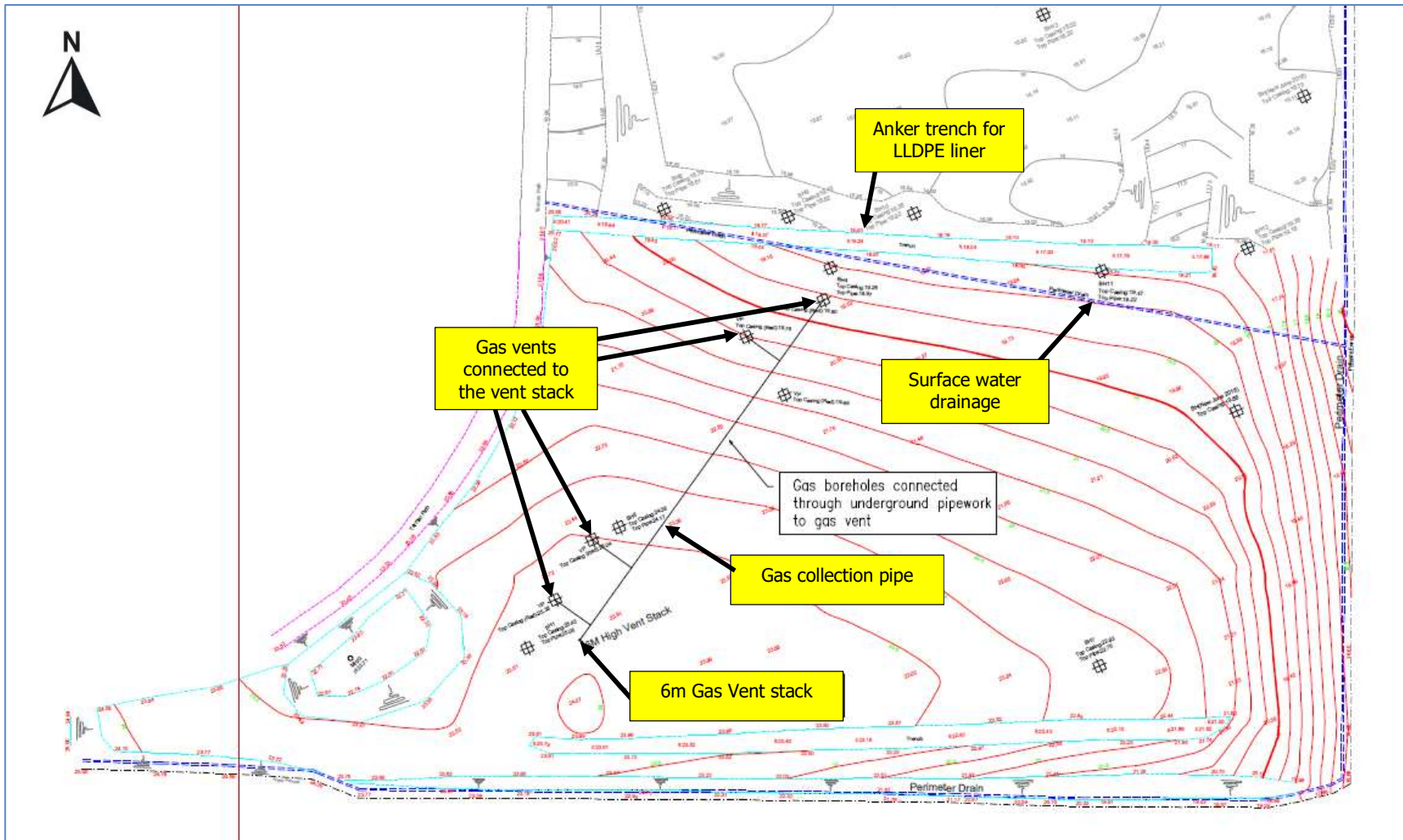


Figure 8: Proposed gas management system and surface water run-off drainage system

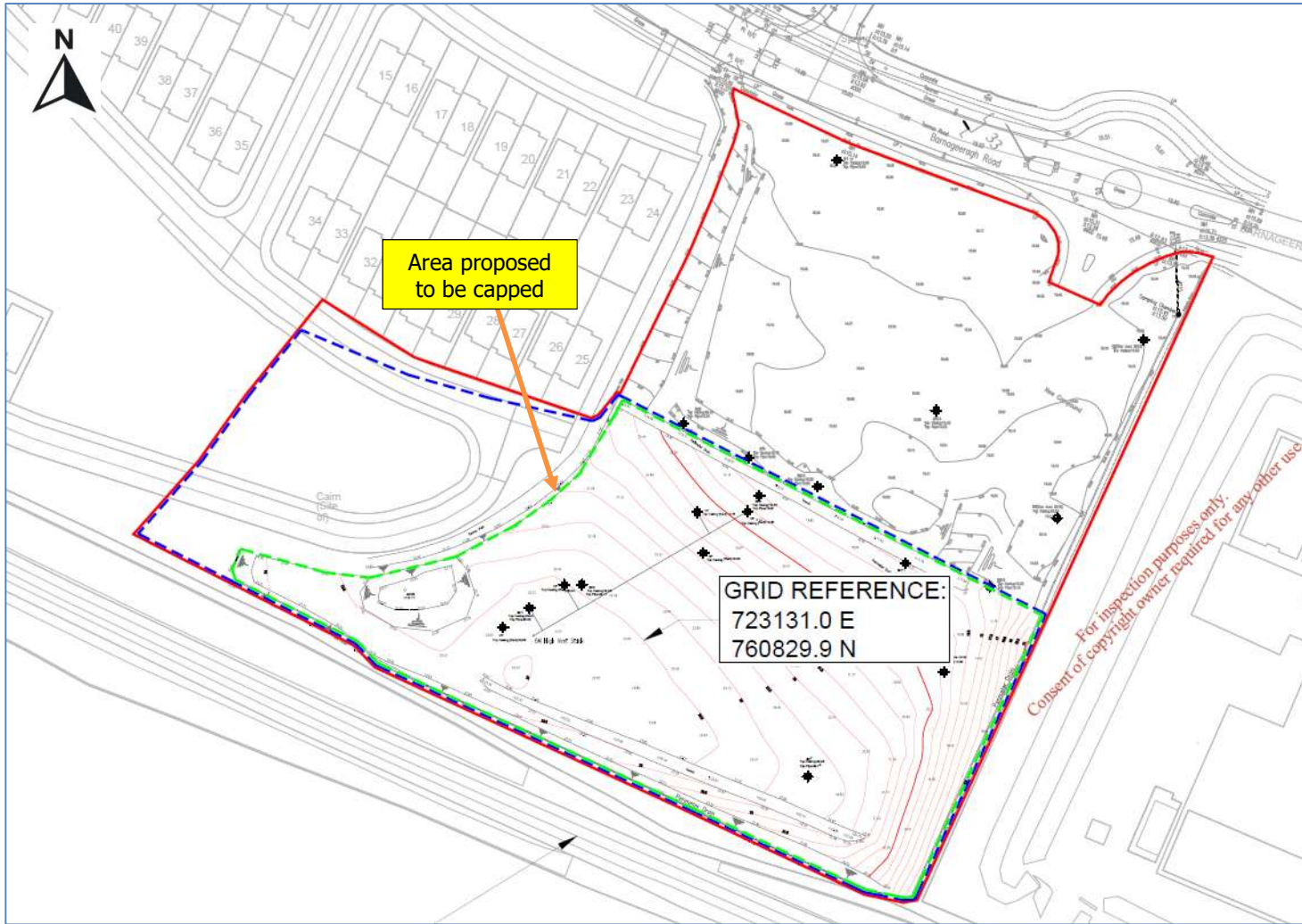


Figure 9: Area proposed to be capped

Appendix 1: Assessment of the effects of activity on European sites and proposed mitigation measures.

European Site	Distance from the facility (km)	Qualifying Interests (* denotes priority habitat)	Conservation Objectives	Assessment
Skerries Islands SPA (Site code: 004122)	3km East of the closed landfill	A017 Cormorant <i>Phalacrocorax carbo</i> A018 Shag <i>Phalacrocorax aristotelis</i> A046 Light-bellied Brent Goose <i>Branta bernicla hrota</i> A148 Purple Sandpiper <i>Calidris maritima</i> A169 Turnstone <i>Arenaria interpres</i> A184 Herring Gull <i>Larus argentatus</i>	NPWS (2020) Conservation objectives for Skerries Islands SPA [004122]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht [dated 7 th April 2020].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Rockabill to Dalkey Island SAC (Site code: 003000)	5km East of the closed landfill	1170 Reefs 1351 Harbour porpoise <i>Phocoena</i>	NPWS (2013) Conservation Objectives: Rockabill to Dalkey Island SAC 003000. Version 1. National Parks and Wildlife	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill</p>

		<i>phocoena</i>	Service, Department of Arts, Heritage and the Gaeltacht [dated 7 th May 2013].	<p>site to surface water.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Rockabill SPA (Site code: 004014)	5.4km East of the closed landfill	A148 Purple Sandpiper <i>Calidris maritima</i> A192 Roseate Tern <i>Sterna dougallii</i> A193 Common Tern <i>Sterna hirundo</i> A194 Arctic Tern <i>Sterna paradisaea</i>	NPWS (2013) Conservation Objectives: Rockabill SPA 004014. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 8 th May 2013].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p>

				<p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
River Nanny Estuary and Shore SPA (Site code: 004158)	9km north-west of the closed landfill	<p>A130 Oystercatcher <i>Haematopus ostralegus</i> wintering</p> <p>A137 Ringed Plover <i>Charadrius hiaticula</i> wintering</p> <p>A140 Golden Plover <i>Pluvialis apricaria</i> wintering</p> <p>A143 Knot <i>Calidris canutus</i> wintering</p> <p>A144 Sanderling <i>Calidris alba</i> wintering</p> <p>A184 Herring Gull <i>Larus argentatus</i> wintering</p> <p>A999 Wetlands</p>	NPWS (2012) Conservation Objectives: River Nanny Estuary and Shore SPA 004158. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 21 st September 2012].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate</p>

				of authorisation ensure the qualifying interests of this European site are protected.
Boyne Coast and Estuary SAC (Site code: 001957)	14.7km north-west of the closed landfill	<p>1130 Estuaries</p> <p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1310 Salicornia and other annuals colonizing mud and sand</p> <p>1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)</p> <p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>2110 Embryonic shifting dunes</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes')</p> <p>2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')</p>	NPWS (2012) Conservation Objectives: Boyne Coast and Estuary SAC 001957. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 31 st October 2012].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Boyne Estuary SPA (Site code: 004080)	16.6km north-west of the closed landfill	<p>A048 Shelduck <i>Tadorna tadorna</i></p> <p>A130 Oystercatcher <i>Haematopus ostralegus</i></p> <p>A140 Golden Plover <i>Pluvialis apricaria</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p> <p>A142 Lapwing <i>Vanellus vanellus</i></p>	NPWS (2013) Conservation Objectives: Boyne Estuary SPA 004080. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 26 February 2013].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions</p>

		<p>A143 Knot <i>Calidris canutus</i> A144 Sanderling <i>Calidris alba</i> A156 Black-tailed Godwit <i>Limosa limosa</i> A162 Redshank <i>Tringa totanus</i> A169 Turnstone <i>Arenaria interpres</i> A195 Little Tern <i>Sterna albifrons</i> A999 Wetlands</p>		<p>required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Lambay Island SAC (Site code: 000204)	12km south-east of the closed landfill	<p>1170 Reefs 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts 1364 Grey seal <i>Halichoerus grypus</i> 1365 Harbour seal <i>Phoca vitulina</i></p>	NPWS (2013) Conservation Objectives: Lambay Island SAC 000204. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 22 nd July 2013].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p>

				<p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Lambay Island SPA (Site code: 004069)	11.8km south-east of the closed landfill	<p>A009 Fulmar <i>Fulmarus glacialis</i></p> <p>A017 Cormorant <i>Phalacrocorax carbo</i></p> <p>A018 Shag <i>Phalacrocorax aristotelis</i></p> <p>A043 Greylag Goose <i>Anser anser</i></p> <p>A183 Lesser Black-backed Gull <i>Larus fuscus</i></p> <p>A184 Herring Gull <i>Larus argentatus</i></p> <p>A188 Kittiwake <i>Rissa tridactyla</i></p> <p>A199 Guillemot <i>Uria aalge</i></p> <p>A200 Razorbill <i>Alca torda</i></p> <p>A204 Puffin <i>Fratercula arctica</i></p>	NPWS (2020) Conservation objectives for Lambay Island SPA [004069]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht [dated 7 th April 2020].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Rogerstown Estuary SAC (Site code:	8km south of the closed	1130 Estuaries	NPWS (2013) Conservation Objectives: Rogerstown	<u>Emissions to Water</u>

000208)	landfill	<p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1310 <i>Salicornia</i> and other annuals colonising mud and sand</p> <p>1330 Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)</p> <p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)</p> <p>2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*</p>	Estuary SAC 000208. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 14 th August 2013].	<p>There will be no emissions from the landfill site to surface water.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
Rogerstown Estuary SPA (Site code: 004015)	8km south of the closed landfill	<p>A043 Greylag Goose <i>Anser anser</i></p> <p>A046 Brent Goose <i>Branta bernicla hrota</i></p> <p>A048 Shelduck <i>Tadorna tadorna</i></p> <p>A056 Shoveler <i>Anas clypeata</i></p> <p>A130 Oystercatcher <i>Haematopus ostralegus</i></p> <p>A137 Ringed Plover <i>Charadrius hiaticula</i></p> <p>A141 Grey Plover <i>Pluvialis squatarola</i></p> <p>A143 Knot <i>Calidris canutus</i></p>	NPWS (2013) Conservation Objectives: Rogerstown Estuary SPA 004015. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 20 th May 2013].	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and</p>

		<p>A149 Dunlin <i>Calidris alpina alpina</i> A156 Black-tailed Godwit <i>Limosa limosa</i> A162 Redshank <i>Tringa totanus</i> A999 Wetlands</p>		<p>characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
<p>Malahide Estuary SAC (Site code: 000205)</p>	<p>11.8km south of the closed landfill</p>	<p>1140 Mudflats and sandflats not covered by seawater at low tide 1310 <i>Salicornia</i> and other annuals colonising mud and sand 1320 <i>Spartina</i> swards (<i>Spartinion maritimae</i>) 1330 Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) 1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>) 2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*</p>	<p>NPWS (2013) Conservation Objectives: Malahide Estuary SAC 000205. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 27th May 2013].</p>	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p>

				<p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>
<p>Malahide Estuary SPA (Site code: 004025)</p>	<p>12km south of the closed landfill</p>	<p>A005 Great Crested Grebe <i>Podiceps cristatus</i> A046 Brent Goose <i>Branta bernicla hrota</i> A048 Shelduck <i>Tadorna tadorna</i> A054 Pintail <i>Anas acuta</i> A067 Goldeneye <i>Bucephala clangula</i> A069 Red-breasted Merganser <i>Mergus serrator</i> A130 Oystercatcher <i>Haematopus ostralegus</i> A140 Golden Plover <i>Pluvialis apricaria</i> A141 Grey Plover <i>Pluvialis squatarola</i> A143 Knot <i>Calidris canutus</i> A149 Dunlin <i>Calidris alpina alpina</i> A156 Black-tailed Godwit <i>Limosa limosa</i> A157 Bar-tailed Godwit <i>Limosa lapponica</i> A162 Redshank <i>Tringa totanus</i> A999 Wetlands</p>	<p>NPWS (2013) Conservation Objectives: Malahide Estuary SPA 004025. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 16th August 2013].</p>	<p><u>Emissions to Water</u></p> <p>There will be no emissions from the landfill site to surface water or air.</p> <p><u>Conclusion:</u></p> <p>Condition 3.1 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.9 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p> <p><u>Emissions to Air</u></p> <p>Recommended certificate of authorisation requires installation of a landfill cap and passive gas venting system.</p> <p><u>Conclusion:</u></p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>