

This Report has been referred to the Board by the Director Eimear Cotter, on 15 January 2024

Signed: Eve O'Sullivan, Programme Officer Dated: 22 January 2024



**OFFICE OF ENVIRONMENTAL
SUSTAINABILITY**

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

TO: Each Director

FROM: Ewa Babiarczyk, Inspector, Circular Economy Programme

DATE: 22 January 2024

RE: Application by **Galway County Council** for a Certificate of Authorisation for a closed landfill at **Tuam Historic Landfill, Rinkippeen, Tuam, County Galway.**

Certificate of Authorisation Register Number **H0192-01.**

1. Application details

Type of facility:	Closed landfill as defined in the Regulations ¹ .
Original site ownership	Galway County Council.
Current site ownership	Galway County Council.
Operator of closed landfill	Galway County Council has operated this site since 1950s.
Proposed use post remedial works	The local authority intends to continue operation of a civic amenity on site. The recommended certificate of authorisation requires however cessation of the operation at the civic amenity, as outlined in detail in Section 3 titled ' <i>Site investigations</i> ' below.
Risk category of closed landfill:	High risk (class A) due to <ul style="list-style-type: none">Lateral migration pathway of landfill gas (SPR10)Vertical migration pathway of landfill gas (SPR11) The principal risk identified is the risk posed to human presence from the lateral and vertical migration of landfill gas.
Historic landfill register number:	S22-02246
Grid Reference	143862 E and 249947 N (ING)
Application received:	25 th November 2021

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

AA screening determination:	16 th February 2022
Publication date for Notice for Public Consultation on Appropriate Assessment:	23 rd August 2023
No of Submissions or Observations on Appropriate Assessment:	There were no Submissions or Observations received.
Regulation 7(4) notice:	16 th February 2022, 31 st March 2022
Additional information received:	Replies to Regulation 7(4) notices received: 4 th May 2022 and 30 th November 2022. Unsolicited information received: 3 rd April 2023.
Name of Qualified Person:	James O'Neill, 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 in the townland of Rinkippeen, approximately 2km south of the town of Tuam, County Galway. The location of the landfill site is shown in Figure 1.
Period of landfilling	1950s to 1998.
Surrounding area	There are agricultural lands to the north, south and east of the site and boglands to the west of the site, as shown in Figure 2. The site can be accessed via the R347 which runs to the east of the site. The Killeelaun river (waterbody code: IE_WE_30C010800, segment code: 30_2244) flows c.120m north of the site and an unnamed river (waterbody code: IE_WE_30C010800, segment code: 30_2639) flows c.80m south of the landfill, as shown in Figure 1. The Killeelaun river and the unnamed river are linked to the landfill surface water drains. There is a work/storage yard located 280m north-east of the waste body, a farmyard located 350m east of the waste body and a golf club 620m east of the waste body. The closest residential dwelling is located c.400m north-east of the site. Planning permission was granted for construction of a solar photovoltaic farm and ancillary infrastructure immediately adjacent to east and north of the landfill ¹ . There is a Section 4 Discharge point from the golf club (Local Authority Reference Number W222/90) located 660km south-east of the site, as shown in Figure 1.

¹ National Planning Application Database (arcgis.com). Date accessed: 16th October 2023.

Area of the closed landfill	The site covers an area of 3.4 ha.
Quantity of waste at the facility	Approximately 232,652 tonnes (145,407.7m ³)
Characterisation of waste deposited	<p>The waste comprises of mixed municipal waste, domestic waste, commercial and industrial (C&I) waste and construction & demolition (C&D) waste. The encountered waste included a layer of bitmac, fragments of timber, plastic, glass, steel, wire, brick, concrete and clothing.</p> <p>The waste was deposited in a single infill area estimated to be 23,300m², as shown in Figure 3. The applicant's correspondence dated October 2022 states that waste is unlikely to be present beneath the civic amenity.</p>

3. Site investigations

Current condition and appearance of closed landfill:	<p>There is a civic amenity within the site boundary comprising of sheds, outbuildings, a makeshift canteen area and bitmac surfacing, as shown in Figure 2. The civic amenity site is operated by Barna Recycling. However, the applicant's correspondence dated October 2022 states that <i>'it is the intention of Galway County Council to regularise the authorisation for the civic amenity'</i>. Accordingly, due to the fact there is no appropriate authorisation for the civic amenity, Condition 1.3 requires that there shall be no operation of this civic amenity without an appropriate waste authorisation. Condition 3.1(a)(i) requires removal of waste stored in the civic amenity facility within 4 months unless an appropriate waste authorisation is applied for within this timeframe.</p> <p>The surface of the closed landfill site is dome-shaped, raising to c.6-7m above the surrounding lands, with relatively steep slopes along the north, west and southern boundaries. The natural ground slopes from east to west falling from 41.2m AOD at the civic amenity to 35.2m AOD at the boglands to the west of the site.</p> <p>The site walkover carried out in 2020 recorded erosion and poaching of the cover layer and exposed geocomposite clay liner (GCL), as shown in Figure 4. Subsidence, water logged areas on landfill capping <i>and 'minor evidence of oxidation (no free water/leachate) to poorly drained/flat area'</i> on the capping was also observed. The Tier 3 assessment recommends that the existing landfill cap be repaired where required with additional soil being added, along with resurfacing of the landfill in parts.</p> <p>The landfill was subject to remediation works post closure. In 1999, a Closure and Remediation Plan was prepared for the landfill site to mitigate the impacts on the surrounding environment and to re-integrate the landfill back into the surrounding landscape. The remediation measures carried out included the installation of surface water drains along the east and west of the boundary and re-grading of the side slopes. In 2001, a geosynthetic clay liner (GCL) capping layer was installed and covered with topsoil. The Non-Technical Summary, dated October 2022, states that it is understood that these remediation works were subject to EPA approval at the time. It is noted that no record of such approval has been provided as part of the application.</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 landfill is unlined; • Waste was placed on top of a cut-off bog atop peat; • The static groundwater level is slightly below the base of the waste body but it may intersect the waste body as the groundwater level fluctuates; • The maximum depth of waste encountered during site investigations is 9.30m (borehole BH02); • The site was capped with soil, a GCL and a topsoil layer. The topsoil is uneven across the landfill; • Waste was observed close to the surface; • Leachate is being generated and migrates outside the waste body; and • Landfill gas is being generated and migrates outside the waste body.
<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"> • A desk study including, but not limited to, studying historical monitoring data for the site as outlined in the <i>Closure & Remediation Plan for Tuam Landfill dated October 1999</i>, Geological Survey Ireland (GSI) maps, National Parks and Wildlife Service maps and Local Authority maps; • Site walkovers were carried out in 2018 and 2020; • Trial pit investigation was carried out at five pits in total in 2020; • Topographical survey was carried out in 2020; • Geophysical surveys to estimate the vertical and lateral extents of the waste body were carried out in 2020 and 2022; • Surface water monitoring at four locations (two rounds were carried out in 2020, one round was carried out in 2021 and one round was carried out in 2022); • Assimilative capacity and mass balance calculations to estimate impact of potential leachate breakouts on surface water; • Waste analysis of three samples from three locations was carried out in 2022; • In-situ permeability testing was carried out in 2022; • Groundwater monitoring (four rounds were carried out in total. Two rounds were carried out at ten locations in 2020, one round at six locations was carried out in 2021 and one round at ten locations was carried out in 2022); • Leachate monitoring (two rounds were carried out; the first round was at two locations in 1999 and the second round was at three locations in 2022);

	<ul style="list-style-type: none"> • Dispersion modelling of leachate contaminants in groundwater; • Gas monitoring (Three rounds were carried out; the first round at ten locations in 2020 and the second round at four locations in 2022); and • LandGEM gas generation modelling was carried out in 2020 and 2022. 										
Hydrology	<p>The closed landfill is located within the catchment of the Corrib (Catchment Identification Number: 30) and the Clare [Galway]_SC_040 sub-catchment (Sub-catchment Id: 30_19).</p> <p>There are surface water drains around the boundary of the landfill. The northern part of the landfill drains via surface water drains constructed along the boundary into the River Killeelaun (waterbody code: IE_WE_30C010800, segment code: 30_2244), located 115m to the north of the landfill. This river flows west before turning sharply south and discharging into River Clare (waterbody code: IE_WE_30C010800, segment code: 30_2902) c.4.5km downstream from the site. The southern section of the site drains into an unnamed river (IE_WE_30C010800, segment code: 30_2639) which discharges into River Clare c.3.8km downstream of the site.</p> <p>The Water Framework Directive (WFD) status assigned to the Killeelaun River and the unnamed river that leads into the River Clare is Poor. Pressures associated with this waterbody are categorised as hydromorphological¹.</p> <p><i>Surface water monitoring</i></p> <p>Four rounds of surface water monitoring at four locations SW01, SW02, SW03 and SW04 were carried out on 1st July 2020, 26th August 2020, 13th July 2021 and 31st May 2022, as shown in Figure 5 and outlined in the below Table.</p> <p><i>Table 1: Surface water monitoring locations</i></p> <table border="1" data-bbox="507 1339 1385 1917"> <thead> <tr> <th data-bbox="507 1339 703 1440">Monitoring location Id</th> <th data-bbox="703 1339 1385 1440">Location</th> </tr> </thead> <tbody> <tr> <td data-bbox="507 1440 703 1563">SW01 upstream</td> <td data-bbox="703 1440 1385 1563">Upstream, 390m north-east of the site on the Killeelaun river.</td> </tr> <tr> <td data-bbox="507 1563 703 1704">SW02 downstream</td> <td data-bbox="703 1563 1385 1704">Downstream, on the surface water drain along the western boundary that leads into the unnamed river.</td> </tr> <tr> <td data-bbox="507 1704 703 1821">SW03 downstream</td> <td data-bbox="703 1704 1385 1821">Downstream, c. 125m south-west of the site on the unnamed river.</td> </tr> <tr> <td data-bbox="507 1821 703 1917">SW04</td> <td data-bbox="703 1821 1385 1917">Downstream, approximately 575m south-west of the site on the unnamed river.</td> </tr> </tbody> </table>	Monitoring location Id	Location	SW01 upstream	Upstream, 390m north-east of the site on the Killeelaun river.	SW02 downstream	Downstream, on the surface water drain along the western boundary that leads into the unnamed river.	SW03 downstream	Downstream, c. 125m south-west of the site on the unnamed river.	SW04	Downstream, approximately 575m south-west of the site on the unnamed river.
Monitoring location Id	Location										
SW01 upstream	Upstream, 390m north-east of the site on the Killeelaun river.										
SW02 downstream	Downstream, on the surface water drain along the western boundary that leads into the unnamed river.										
SW03 downstream	Downstream, c. 125m south-west of the site on the unnamed river.										
SW04	Downstream, approximately 575m south-west of the site on the unnamed river.										

¹ Source: Water Framework Directive (WFD) website available at https://wfd.edenireland.ie/waterbody/ie_we_30c010800/characterisation?charIt=CI000002 (accessed 8th September 2023).

The results of the surface water monitoring on 31st May 2022, where exceedances were recorded, are shown in the Table below.

Table 2: Surface water monitoring, 2022

Parameter	EQS ¹ / Parametric values ²	Monitoring locations			
		Upstream	Downstream		
		SW1	SW2	SW3	SW4
Ammoniacal Nitrogen [mg/l]	≤ 0.090 ¹ High status, 95%, for Total Ammonia [mg N/l]	0.054	0.139	0.029	0.03
Manganese [µg/l]	50 ²	49.6	50.3	35.3	12.5
Phosphorus [mg/l]	≤ 0.045 ¹ High status, 95%, for Molybdate Reactive Phosphorus (MRP) [mg/l] ²	0.067	0.014	0.013	0.014
Iron [mg/l]	0.2 ²	0.19	0.198	0.212	0.21
Dieldrin [µg/l]	0.01 ¹	<0.01	<0.01	0.039	<0.015
Benzo(a)pyrene [µg/l]	0.00017 ¹	<1	<1	<1	<1

The surface water monitoring results show exceedances of the EQS's for total ammonia and dieldrin and exceedances of the parametric values for manganese and iron at downstream locations. These exceedances indicate that leachate may be migrating into the surface water drain downstream of the landfill. The applicant's correspondence dated October 2022 states that the presence of dieldrin in the surface water is likely associated with historic agricultural activities. Results of leachate monitoring do not show the presence of dieldrin above the limits of detection (<0.01 µg/l). It is further noted that it cannot be determined whether the actual concentration for benzo(a)pyrene was within the relevant standard as the limit of detection for the monitoring methods utilised was above the EQS. It is also noted that the exceedance of MRP at the upstream location indicates other activities not related to the landfill that may be causing contamination in the adjacent surface waters.

Condition 3.9(d) and Schedule A.3 require quarterly monitoring at the upstream monitoring location SW1 and the downstream monitoring

¹ European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

² European Union (Drinking Water) Regulations 2023.

	<p>locations SW2, SW3 and SW4. In addition, Condition 3.9(g) requires that the limit of detection of the monitoring methods utilised shall be below the relevant standard reference values and parametric values.</p>
<p>Hydrogeology</p>	<p>The closed landfill lies within the Clare-Corrib groundwater body (GWB Number: IE_WE_G_0020). The status of this groundwater body is Good but this waterbody is at risk. The site is underlain by a bedrock aquifer which is classified as a Regionally Important Aquifer - Karstified (conduit) (Rkc). The aquifer vulnerability beneath the site varies from Low, Moderate to High. The Tier 2 assessment states that it is expected that the static groundwater level may be slightly below the base of the waste body. However, the Tier 2 assessment further states that groundwater levels can fluctuate seasonally, and therefore, groundwater may intersect the landfill depending on weather conditions. Groundwater beneath the site flows in a generally westerly direction, as shown in Figures 6 and 8.</p> <p>The closed landfill is located 11.6km north-west from the Mid Galway Public Water Supply (PWS Id. 1200PUB1038_2) which abstracts water from a groundwater spring. The Mid Galway PWS source protection zone is located approximately 11.1km south-east of the site. Due to the fact that groundwater beneath the site flows in a generally westerly direction, there will be no impact on this PWS from the closed landfill.</p> <p>Claretuam Belclare Group Water Scheme (GWS) groundwater protection zone is located c.4.6km west of the landfill. Also, there are four groundwater boreholes located downgradient of the site, within 3.5km of the site. The nearest of these boreholes is located 1.6km north-east of the site (borehole Id. 1425SWW025; unknown use), the second borehole (borehole Id. 1425SWW024; also unknown use) is located 1.6km north-east of the site, the third borehole (borehole Id. 1423NWW003) is located c.3km south-west of the site and is used for agri and domestic purposes and the fourth borehole (borehole Id. 1423NWW014; Group Scheme use) is located c3.4km south-west. Due to the fact that groundwater beneath the site flows in a generally westerly direction, there may be a potential impact on the Claretuam Belclare GWS and the above two groundwater boreholes to the south-west. However, the appropriate capping will limit ingress of rainwater into the waste body thus limiting the generation of leachate which may impact groundwater.</p> <p>Condition 3.9(e) requires monitoring of groundwater in accordance with Schedule A.4, which requires groundwater monitoring upgradient and downgradient of the waste body on a quarterly basis and specifies the minimum parameters to be monitored. Furthermore, Condition 3.4 requires appropriate monitoring on a biannual basis to identify any impact on the quality of water abstracted at wells downgradient of the landfill, if required by the Agency based on the well positions, and the assessment of the monitoring results against drinking water standards.</p>
<p>Leachate and water quality:</p>	<p><u><i>Trial pit investigation</i></u></p> <p>Trial pit investigation was carried out at five trial pits (TP01 to TP05) on 7th July 2020, as shown in Figure 7. The trial pit depths varied from between 0.2m below ground level (bgl) to 2.0m bgl. The geocomposite clay liner was identified between the depths of 0.2m to 0.4m bgl in TP01, TP02, TP03 and TP05. These four trial pits were not advanced any further to not compromise the GCL liner. Bitmac was identified between depths of 0.25m bgl and 0.3m bgl in trial pit TP04 where made ground</p>

comprising of timber, plastic, glass, steel, wire, brick and concrete, and clothing was encountered. TP04 terminated at a depth of 2m bgl.

Permeability Testing of the existing capping material

Bulk disturbed soil samples from trial pits TP01 and TP02 were submitted for geotechnical analysis in August 2020. Each soil sample was analysed for, among other parameters, particle size distribution (PSD) and Liquid and Plastic Limits. Both soil samples were described as 'Brown sandy gravelly clayey SILT'.

Additionally, permeability by triaxial cell tests and in-situ hydraulic conductivity by double ring infiltrometer assessment was carried out on two samples at boreholes BH01 and BH03. The Table below shows the results.

Table 3: Permeability and hydraulic conductivity results

Borehole Id.	Permeability [m/s]	Hydraulic Conductivity [s ⁻¹]
BH01	8.6x10 ⁻⁹	0.0013279
BH03	2.0x10 ⁻⁹	0.0011363

The Tier 2 assessment states that the results demonstrate that the existing capping does not achieve a hydraulic conductivity of less than or equal to 1x10⁻⁹m/s, as recommended in the EPA Landfill Manuals – Landfill Site Design, however it is highly impermeable.

Waste analysis

Bulk waste samples were obtained on 22nd July 2022 during the reinstallation of the three leachate (and gas) monitoring boreholes, BH01 – BH03 within the waste body at varying depths. These were analysed for a number of parameters in accordance with the waste acceptance criteria at landfills¹, as shown in the Table below.

Table 4: Waste analysis results

Parameter	Landfill Waste Acceptance Criteria Limits ¹			Sample		
	Inert	Non-haz	Haz	BH01 6.0m bgl	BH02 2.5m bgl	BH03 5.0m bgl
Total Organic Carbon [%]	3	5	6	11	5.8	0.52
Loss on Ignition [%]	-	-	10	29	11	10
10:1 Eluate						
Antimony	0.06	0.7	5	0.19	0.039	0.15

¹ Waste Acceptance Criteria (WAC) as 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.

[mg/kg]							
Chloride [mg/kg]	800	15,000	25,000	130	670	790	
Fluoride [mg/kg]	10	150	500	9.4	1.3	2.1	
Sulphate [mg/kg]	1,000	20,000	50,000	1,400	4,800	1,800	
Total Dissolved Solids [mg/kg]	4,000	60,000	100,000	8,400	8,600	5,800	
Dissolved Organic Carbon [mg/kg]	500	800	1000	520	310	730	

The results show that the concentration of total organic carbon at BH01 and loss of ignition at each location meets the hazardous landfill waste acceptance criteria. The results also show the concentrations of antimony, sulphate, total dissolved solids and dissolved organic carbon meet the non-hazardous landfill waste acceptance criteria. The applicant did not comment on the concentrations of these parameters in the soil samples.

Leachate monitoring

There were two rounds of leachate monitoring. The first round was carried out in monitoring borehole BH3, as shown in Figure 7, and a leachate contaminated pool L1 in 1999. The applicant’s correspondence dated October 2022 states that the exact location of the leachate pool is unknown and it is clear from observations of the site that the pool no longer exists. The second round of leachate monitoring was carried out in boreholes BH01, BH02 and BH03 which were installed within the waste body in July 2022 and were monitored on 10th August 2022, as also shown in Figure 7. The Table below shows the monitoring parameters for which exceedances were recorded.

Table 5: Leachate sampling results, August 2022

Parameter	Groundwater Threshold Value /Limit ^{1,2,3}	BH01	BH02	BH03
Ammoniacal Nitrogen [mg/l]	0.065 ¹ Ammonium as N	68	96.2	255

¹ Groundwater threshold value (GTV), as set out in the European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

² Environmental quality standard (EQS), as set out in the Environmental Quality Standard (EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

³ Interim guideline values (IGV), as set out in the EPA publication ‘Towards setting guideline values for the protection of groundwater in Ireland – Interim Report’, 2003.

Phosphorus [$\mu\text{g/l}$]	Molybdate Reactive Phosphorus (MRP) 35 $\mu\text{g/l}$ ¹	290	118	320
Chloride [mg/l]	187.5 ¹	440	70.2	739
Conductivity at 20°C [mS/cm]	1 ³	3.12	1.98	6.33
Biochemical oxygen demand BOD [mg/l]	2.2 ²	60.5	42.8	166
Sulphate [mg/l]	187.5 ¹	176	133	513
Barium [$\mu\text{g/l}$]	100 ³	261	215	233
Boron [$\mu\text{g/l}$]	750 ¹	904	456	1,470
Chromium [$\mu\text{g/l}$]	7.5 ¹	3.22	3.03	27.1
Lead [$\mu\text{g/l}$]	7.5 ¹	0.644	14.6	0.224
Manganese [$\mu\text{g/l}$]	50 ³	141	1,790	3,390
Nickel [mg/l]	15 ¹	13.2	10.7	57.2
Zinc [$\mu\text{g/l}$]	75 ¹	4.25	149	4.47
Sodium [mg/l]	150 ¹	1,090	87.5	740
Magnesium [mg/l]	50 ³	64.9	55.6	184
Potassium [mg/l]	5 ³	120	59.4	227
Calcium [mg/l]	200 ³	56.7	210	165
Iron [mg/l]	0.2 ³	3.3	2.01	6.48
Dieldrin [$\mu\text{g/l}$]	0.075 ¹	<0.01	<0.01	<0.01
Naphthalene [$\mu\text{g/l}$]	Polycyclic Aromatic Hydrocarbons (PAHs) 0.075 ¹	<20	<10	<10
Anthracene [$\mu\text{g/l}$]		<20	<10	<10
Benzo(b)fluoranthene [$\mu\text{g/l}$]		21.6	<10	<10
Benzo(k)fluoranthene [$\mu\text{g/l}$]		<20	<10	<10
Benzo(ghi)perylene [$\mu\text{g/l}$]		<20	<10	<10
Indeno(1,2,3-cd)pyrene		<20	<10	<10

The leachate monitoring results show exceedances in the groundwater threshold values of ammoniacal nitrogen, MRP, chloride, sulphate, boron, chromium, lead, nickel, zinc, sodium and PAHs. Furthermore, the monitoring results show exceedance of EQS for BOD and of IGVs for conductivity, barium, manganese, magnesium, potassium, calcium and iron.

Condition 3.9(b) and Schedule A.1 require leachate monitoring in the existing leachate monitoring borehole BH01, BH02 and BH03 on a biannual basis. Schedule A.1 specifies the minimum parameters to be monitored.

Modelling of leachate contaminants dispersion in groundwater

The applicant used the UK EA Remedial Targets Worksheet model to examine the potential impacts of leachate on aquifer/groundwater

quality. The model predicted concentrations of ammoniacal nitrogen at 15m, 75m, 150m and 300m downstream of the site after 25, 50 and 100 years of dispersion. The model assumes no mitigation in place in respect to reducing infiltration of rainfall into the waste body and the subsequent generation of leachate. The model also assumes a worst-case scenario of a non-depleting source concentration where there is no degradation or dilution of the source.

Table 6: Modelled downstream concentration results

Ammoniacal nitrogen [mg/l]		Groundwater threshold value (GTV) ¹ = 0.175 mg/l			
Years of dispersion	Initial plume conc. [mg/l]	Conc. at 15m [mg/l]	Conc. at 75m [mg/l]	Conc. at 150m [mg/l]	Conc. at 300m [mg/l]
25	1,019	293.321	0.24	0.00	0.00
50	1,019	408.39	8.70	0.001	0.00
100	1,019	523.53	59.93	0.56	0.00

The modelling results show that the predicted concentrations of ammoniacal nitrogen exceed the GTV for ammonium of 0.175 mg/l at 15m, 75m and 150m from the site. It is noted that the exceedances at 15m from the site are significantly above the GTV and that, although reduced, exceedances still occur at 75m. The Updated Non-Technical Summary states that the dispersion modelling and calculations show that on a regional scale the migration of leachate to groundwater is unlikely to impact on the overall quality of the underlying Clare-Corrib GWB, due to the natural containment provided by the underlying peats and clays and the presence of the geocomposite clay layer limiting the percolation of rainwater through the waste body.

Accordingly, Condition 3.1(c) requires the installation and maintenance of a low permeability landfill cap over the waste body in accordance with the EPA Landfill Manuals – Landfill Site Design.

Impact of potential leachate breakouts on surface water

The applicant carried out an assimilative capacity and mass balance calculations to estimate the impact of potential leachate breakouts on the River Clare. The calculations concluded that the available assimilative capacity for ammoniacal nitrogen in the river is 16.86 kg/day. The calculations also estimated how leachate breakouts contribute to an increase in concentration of ammoniacal nitrogen downstream of the landfill and on the available assimilative capacity. The daily mass emission decided upon was the maximum recorded concentration measured at SW2 in 2020 of 4.79 mg/l. The Table below shows the calculation results.

Table 7: Assimilative capacity and mass balance calculations results

Leachate breakout flow	Leachate mass emission	Impact of the breakout on	Downstream conc. of

¹ As set out in the European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

[m ³ /day]	assuming ammoniacal nitrogen at 4.79 mg/l [kg/day]	assimilative capacity of 16.86 kg/day [%]	ammoniacal nitrogen [mg/l]
12	0.057	0.3%	0.021
5.8	0.028	0.2%	0.021

The calculation results show that at a leachate discharge rate of 12 m³/day and at a concentration of 4.79 mg/l, the predicted downstream concentration of ammoniacal nitrogen is 0.021 mg/l (0% increase), not exceeding the carrying capacity of the river. The updated Non-Technical Summary states that assimilative capacity assessment and mass balance calculation indicates that the leachate produced at the site and discharging via adjacent land drains is unlikely to negatively impact on water quality of the Clare River.

Condition 3.1(e) requires that the local authority shall assess the need to install a cut-off barrier system to prevent leachate breakouts to the adjacent drains in accordance with the EPA Landfill Manuals – Landfill Site Design. Condition 3.1(f) requires that a cut-off barrier system is installed, operated and maintained, if required following the assessment in accordance with Condition 3.1(e).

Groundwater monitoring

Twelve groundwater monitoring boreholes were installed for purposes of the Risk Assessment site investigations, as shown in Figure 7 and outlined in Table 8 below.

Table 8: Groundwater borehole locations

Borehole Id., depth [m] and year installed	Location	Stratum
RC2 10m 1992	Cross-gradient, c.50m north of the site	Limestone
RC3 23m 1992	Cross-gradient, c.50m north of the site of site	Limestone
2AP 1.15m 1992	Downgradient, c.50m south-west of the site	Peat
3AP 1.2m 1992	Cross-gradient, c.150m south-west of the site	Peat
4AP 1.3m 1992	Downgradient, c.50m west of the site	Saturated Peat
5A 4.6m 1992	Downgradient, c.150m north-west of site	Shattered limestone rock
5AP 1.5m	Downgradient, c.150m north-west of the site	Peat

	1992		
	8A 6.75m 1992	Upgradient, at entrance to the civic amenity	Limestone
	8AP 1.0m 1992	Upgradient, at the entrance to the civic amenity	Peat
	GW01 5m 2020	Downgradient, c. 60m south of the site	<ul style="list-style-type: none"> • Topsoil to 0.1m bgl. • Brown sandy gravelly SILT between 1m and 3m bgl; • Grey sandy gravelly CLAY with low cobble content between 3 and 5m bgl. <p>No water encountered.</p>
	GW02 12m 2020	Downgradient, 60m south of the site	<ul style="list-style-type: none"> • Topsoil to 0.1m bgl. • Brown PEAT between 0.1 and 1m • Brown sandy gravelly SILT between 1m and 3m bgl; • Grey sandy gravelly CLAY with low cobble content between 3 and 4.5m bgl. • Grey sandy fine to coarse Gravel between 4.5 and 6.4 • Grey LIMESTONE between 6.4 and 12m bgl. <p>Water strike at 5m.</p>
	BHLFG1 also referred to by applicant as LFG1 and LFG01 3m 2022	At the civic amenity	<ul style="list-style-type: none"> • Bitmac to 0.05m bgl. • Varying Made Ground from 0.05m to 2.5m bgl. • Peat between 2.5m and 3m bgl. <p>No water encountered.</p>

There were four rounds of groundwater monitoring. Ten boreholes BH3, 2AP, 3AP, 4AP, 5A, 5AP, 8A, 8AP, RC2 and RC3 were monitored in total on 1st July 2020 and 27th August 2020, as shown in Figure 7. Six boreholes 5A, 8A, 3AP, GW01, RC2 and RC3 were monitored on 13th July 2021 and ten boreholes 5A, 8A, RC2, RC3, 3AP, 4AP, 5AP, 8AP, GW01 and GW02 were monitored on 31st May 2022, as also shown in Figure 7. Groundwater monitoring locations GW01 and GW02 are relatively close to each other. The Table below shows the groundwater monitoring results from the upgradient monitoring borehole 8A and downgradient monitoring boreholes 4AP, GW01 and RC2 from the monitoring event in 2022.

Table 9: Groundwater monitoring results, 31st May 2022

Parameter	GTV/ Limit 1,2,3,	8A Up- gradient	4AP Down- gradient	GW01 Down- gradient	RC2 Down- gradient
Ammoniacal Nitrogen as N [mg/l]	0.065 ¹ Ammonium as N	11.9	0.984	2.01	2.72
Phosphorus [µg/l]	Molybdate Reactive Phosphorus (MRP) 35 µg/l ¹	1,970	1,940	143	90.6
Chloride [mg/l]	24 ¹	66	45.6	31.2	18.2
Potassium [mg/l]	5 ²	6.56	54	2.26	2.44
Arsenic [µg/l]	7.5 ¹	64.7	4.48	3.14	1.37
Barium [µg/l]	100 ²	41.9	217	83.7	35.9
Iron [mg/l]	0.2 ²	16.4	38.8	5.86	8.49
Nickel [µg/l]	15 ¹	3.58	4.08	8.22	3.25
Manganese [µg/l]	50 ²	364	926	112	119
Dieldrin [µg/l]	0.075 ¹	<0.02	0.141	<0.1	<0.02
Mecoprop [µg/l]	0.075 ¹	<0.2	1.01	<0.4	<0.04
Naphthalene [µg/l]	Total Polycyclic Aromatic Hydrocarbons 0.075 ¹	<4	<4	<4	<1
Anthracene [µg/l]		<4	<4	<4	<1
Benzo(b)fluoranthene [µg/l]		<4	<4	<4	<1
Benzo(k)fluoranthene [µg/l]		<4	<4	<4	<1
Benzo(ghi)perylene [µg/l]		<4	<4	<4	<1
Indeno(1,2,3-cd)pyrene		<4	<4	<4	<1

¹ Groundwater Threshold Values from European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

² Interim Guideline Values (IGV) as set out in the EPA publication 'Towards setting guideline values for the protection of groundwater in Ireland – Interim Report', 2003.

³ Parametric values from European Union (Drinking Water) Regulations 2014, S.I. No. 122 of 2014.

	<p>The monitoring results at the downgradient locations show exceedances of the GTVs for ammonium, chloride, arsenic and dieldrin and IGVs for potassium, barium, iron and manganese. The Tier 2 assessment states that the elevated concentrations of ammoniacal nitrogen may be attributed to agricultural activities as well as the presence of peat in the area. It is further noticed that in July 2020 the parametric values for total coliforms were exceeded at the upstream location 8AP (64.2 mpn/100ml) but were significantly exceeded at downstream locations RC2 (817 mpn/100ml), RC3 (52,000mpn/ml) and GW01 (>2,419.6mpn/100ml) in July 2020. The Tier 2 assessment states that the presence of faecal coliforms in groundwater is not likely attributed to the historical landfill, but more likely present from agricultural or domestic sources i.e. human/animal waste, slurry and septic tanks. It is further noted that groundwater samples were not tested for coliforms in 2022. Furthermore, it is noted that the source dieldrin is likely to be due to historic agricultural activities. The above monitoring results also show that other sources apart from the landfill may also be impacting results as a number of parameters exceed their relevant thresholds limits at the upgradient monitoring location 8A. The Tier 2 assessment states that groundwater monitoring conducted in 2020 and 2022 and the historical groundwater monitoring results <i>'do indicate that leachate migration is impacting groundwater quality immediately downgradient of the site, to the west, however this impact has not been observed further from the site at monitoring locations further downgradient (>200m west).'</i></p> <p>Condition 3.9(e) requires groundwater monitoring for parameters on a quarterly basis in accordance with Schedule A.4. Also, based on the monitoring results above and as the waste contains municipal waste and industrial waste, it is considered that monitoring for organic compounds in the groundwater is appropriate. Accordingly, Condition 3.9(f) requires an annual screening of groundwater for trace organic substances.</p>
Landfill gas:	<p>There is a risk of lateral and vertical landfill gas migration to the civic amenity buildings through the underlying peat and the existing landfill cover material.</p> <p><u><i>Landfill gas monitoring</i></u></p> <p>Gas monitoring was carried out on 1st July 2020 and 27th August 2020 at one monitoring location within the waste body BH3 and nine monitoring wells 2AP, 3AP, 4AP, 5A, 5AP, 8A, 8AP, RC2 and RC3 and on 9th August 2022 at three (reinstalled after borehole damage/loss) locations within the waste body BH01, BH02, BH03 and location BHLFG1 within the civic amenity facility, as shown in Figure 7.</p> <p>The Table below shows the maximum concentrations of methane and carbon dioxide measured at the ten groundwater boreholes during the monitoring in July 2020 and August 2022. The monitoring locations within the waste body are highlighted in orange.</p>

Table 10: Landfill gas monitoring results, July 2020 and August 2022

Bore-hole Id	Monitoring 1 st July 2020		Monitoring 9 th August 2022		Trigger levels outside the waste body ¹	
	Methane (% v/v)	Carbon dioxide (% v/v)	Methane (% v/v)	Carbon dioxide (% v/v)	Methane (% v/v)	Carbon dioxide (% v/v)
BH3	0	0.6			1	1.5
2AP	0	0.9				
3AP	0	0.3				
4AP	0	0.6				
5A	0	1.2				
5AP	0	1				
8A	0	1.8				
8AP	0	1.7				
RC2	0	0.9				
RC3	0	1.5				
BH01			25.6	9.8		
BH02			41.2	11.5		
BH03			67.7	17.2		
BHLFG1 Civic amenity			0.2	0.8		

The monitoring results show very high concentrations of both methane (maximum concentration of 67.7% v/v in BH03) and carbon dioxide (maximum concentration of 17.2% v/v also in BH03) measured in the three boreholes, BH01 to BH03, within the waste body. It is noted that these three boreholes are leachate monitoring boreholes and therefore, the gas readings may not be representative of the actual gas conditions within the landfill. EPA Landfill Monitoring Manual² states that leachate monitoring wells are inappropriate for gas monitoring purposes within the waste body. However, the monitoring results do show that landfill gas is being generated within the landfill and may be migrating outside the waste body, as the 1.5% trigger level for carbon dioxide outside the waste body was exceeded in July 2020 at three locations (1.8% v/v at 8A, 1.7% at 8AP and 1.5% v/v at RC3).

It is noted that the applicant did not recommend any gas management system for the landfill. Considering the gas monitoring results and the proposed installation of a landfill cap which may result in the lateral migration of gas outside the waste body, it is considered that passive gas vents are appropriate for the site. Accordingly, Condition 3.1(d)(i) requires installation of passive gas vents within the waste body and that

¹ As set out in the EPA Landfill Manuals - Landfill Monitoring, 2nd Edition, 2003.

² EPA Landfill Manuals – Landfill Monitoring, 2nd Edition, 2003.

	<p>spacing between the gas vent pipes shall be sufficient to achieve adequate gas venting. Condition 3.9(c) requires gas monitoring in accordance with Schedule A.2, which requires monitoring of landfill gases and gas flow on a quarterly basis. Condition 3.12 enables changes to monitoring requirements, with the agreement of the Agency following evaluation of test results and/or relevant proposals. In addition, Condition 3.11 requires gas monitoring at all relevant buildings, including domestic dwellings, adjacent to the landfill, subject to owner's permission.</p> <p><u>Gas modelling</u></p> <p>LandGEM gas modelling was carried out on 17th November 2020 and on 26th October 2022. The modelling shows that gas will continue to be generated for several years. The Table below shows the predicted gas generation results to 2030.</p> <p><i>Table 11: Estimated landfill gas generation (2020 to 2030)</i></p> <table border="1" data-bbox="507 745 1385 1267"> <thead> <tr> <th rowspan="2">Gas/ pollutant</th> <th colspan="2">Tonnes/year</th> <th colspan="2">Tonnes/hr</th> <th colspan="2">m³/hr</th> </tr> <tr> <th>2020</th> <th>2030</th> <th>2020</th> <th>2030</th> <th>2020</th> <th>2030</th> </tr> </thead> <tbody> <tr> <td>Total landfill gas</td> <td>430</td> <td>261</td> <td>0.05</td> <td>0.03</td> <td>39</td> <td>24</td> </tr> <tr> <td>Methane</td> <td>115</td> <td>70</td> <td>0.01</td> <td>0.01</td> <td>20</td> <td>12</td> </tr> <tr> <td>Carbon dioxide</td> <td>315</td> <td>191</td> <td>0.04</td> <td>0.02</td> <td>20</td> <td>12</td> </tr> <tr> <td>Non-methane organic compounds (NMOC)</td> <td>5</td> <td>3</td> <td>0.001</td> <td>0.000</td> <td>0.16</td> <td>0.10</td> </tr> </tbody> </table> <p>The LandGEM model predicted that in 2020 the site was generating 20 m³/hr methane and that methane generation will reduce to 12 m³/hr by 2030. The modelled gas rates fall within the gas rate ranges for which technologies like passive venting or biofiltration are recommended in EPA 'Management of Low Levels of Landfill Gas' publication.</p>	Gas/ pollutant	Tonnes/year		Tonnes/hr		m ³ /hr		2020	2030	2020	2030	2020	2030	Total landfill gas	430	261	0.05	0.03	39	24	Methane	115	70	0.01	0.01	20	12	Carbon dioxide	315	191	0.04	0.02	20	12	Non-methane organic compounds (NMOC)	5	3	0.001	0.000	0.16	0.10
Gas/ pollutant	Tonnes/year		Tonnes/hr		m ³ /hr																																					
	2020	2030	2020	2030	2020	2030																																				
Total landfill gas	430	261	0.05	0.03	39	24																																				
Methane	115	70	0.01	0.01	20	12																																				
Carbon dioxide	315	191	0.04	0.02	20	12																																				
Non-methane organic compounds (NMOC)	5	3	0.001	0.000	0.16	0.10																																				
Conceptual site model:	<p>Tier 1 Assessment determined that the overall risk score for the closed landfill was High (Class A). This classification was due to the risk of lateral migration of landfill gas (SPR 10) and vertical migration of gas (SPR 11). Following Tier 2 and Tier 3 investigations this risk classification remains High (Class A), due to the risk of lateral and vertical gas migration into to civic amenity buildings.</p> <p>The conceptual site model is shown in Figure 8.</p>																																									

4. SPR linkages and remedial actions

SPR linkage scenarios	<p>Leachate and gas migration scores:</p> <p><u>High scores:</u></p>
-----------------------	---

<p>(applicable ones only):</p>	<p>Two pathways were identified as High 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); • Vertical landfill gas migration (SPR 11). <p><u>Moderate scores:</u></p> <p>Four pathways were identified as Moderate Risk:</p> <ul style="list-style-type: none"> • Migration of leachate, via groundwater flowing to water drainage/runoff, to surface waterbodies (SPR 1); • Migration of leachate to the underlying aquifer (SPR 5); • Migration of leachate, via groundwater migration, to surface water bodies (SPR 7); • Migration of leachate, via surface water drainage/runoff, to surface water bodies (SPR 8). <p><u>Low scores:</u></p> <p>Two pathways were identified as Low Risk:</p> <ul style="list-style-type: none"> • Migration of leachate to private wells (SPR 3); and • Migration of leachate to public water supplies (SPR 6). <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 migration of landfill gas off-site. • remedial action is warranted to address the risk of leachate migrating from the site into surface water and groundwater.
<p>Proposed remedial actions:</p>	<p>The applicant considered the following remedial measures as the feasible options:</p> <p><i>1 Landfill capping</i></p> <p>Tier 3 assessment proposes that landfill capping works be limited to the repair of the existing cap where erosion, poaching and exposure of the GCL has occurred and states that additional soil may be required for repairs and resurfacing of the cap. Figure 9 shows the extent of the existing landfill cap and area of poaching proposed to be repaired.</p> <p>Condition 3.1(c) requires a low permeability landfill cap over the entire waste body, minimum 1m with 1mm thick low permeability geomembrane, or equivalent, to achieve a hydraulic conductivity of less than or equal to $1 \times 10^{-9} \text{m/s}$. Condition 3.1(c)(iii) requires the reprofiling of the gradients to provide for rainwater run-off from the surface of the landfill. Condition 3.13 requires that only greenfield soil and stone, including greenfield soil and stone that meets by-product criteria, or soil and stone of equivalent nature and character, in terms of chemical and physical composition, can be imported for use in remedial, corrective, or other engineering works at the site.</p>

2 Landfill gas

The Tier 3 assessment recommends that the remediation measures with respect to gas are limited to '*routine (continuous) monitoring for landfill gas at the nearest sensitive receptor, the CA facility adjacent to the landfill*'. The Tier 3 assessment further states that the existing GCL and the soil cap are '*likely limiting diffuse vertical migration of landfill gas which can force landfill gas to migrate laterally*' and states that a gas collection/drainage layer is not necessary in the final capping as the majority of gas has vented over the lifetime of the landfill and that the waste had been covered by a '*final capping material*'.

Due to the fact that the landfill gas is being generated and migrates outside the waste body, as recorded in boreholes 8A, 8AP and RC3, Condition 3.1(d)(i) requires installation of gas vents within the waste body. Condition 3.1(d)(i) further requires that spacing between the gas vents needs to achieve adequate gas venting.

3 Environmental monitoring

3.1. Groundwater monitoring

The Tier 3 assessment recommends the addition of two upgradient monitoring locations GW03-S (shallow well) and GW03-D (deep well), as shown in Figure 10, to become part of the continual groundwater monitoring for the site. It is noted however that these wells are located in close proximity, c.40m north, of the existing upgradient boreholes 8A and 8AP. Accordingly, it is considered that monitoring at the existing upgradient locations is considered sufficient.

The Tier 3 assessment further recommends a quarterly monitoring of the downgradient boreholes 4AP, 5AP, GW01, GW02 and the annual monitoring of the cross-gradient boreholes RC2 and RC3 and the upgradient boreholes 8A and 8AP. It is noted however that boreholes 8A and 8AP are located only a few metres apart from each other therefore, only one of them, borehole 8A, which is deeper (6.75m deep) than 8AP (1m deep), is recommended to be monitored.

It is considered that a quarterly monitoring frequency for all groundwater monitoring locations is appropriate. Accordingly, this is set out in Condition 3.9(e) and Schedule A.4. Condition 3.12 provides for change of the monitoring scope if necessary, following evaluation of test results and/or relevant proposals.

3.2 Leachate monitoring

The Tier 3 assessment recommends leachate monitoring at the existing leachate monitoring boreholes BH01, BH02 and BH03 within the waste body on a biannual basis.

Accordingly, this is set out in Condition 3.9(b) and Schedule A.1.

3.3 Surface water monitoring

The Tier 3 recommends monitoring at the existing upgradient location SW1 and downgradient locations SW2, SW3 and SW4 on a quarterly basis.

Accordingly, this is set out in Condition 3.9(d) and Schedule A.3.

3.4 Landfill gas monitoring

The Tier 3 recommends gas monitoring at the existing boreholes 4AP, 5AP, 8A and 8AP, GW01, GW02, RC2, RC3 and LFG1 at the civic amenity facility, as shown in Figure 10. As stated above, boreholes 8A and 8AP are located only a few metres apart from each other therefore, only one of them, borehole 8A, is recommended to be monitored in Schedule A.2.

Tier 3 assessment further recommends that, due to the presence of buildings immediately adjacent to the landfill and the risk that these buildings may also be underlain by waste, and human activity on the site, continuous gas monitors in all enclosed areas within buildings on site.

Additionally, Tier 3 assessment recommends that a 'full internal survey of all buildings and spaces potentially at risk' be undertaken to identify all enclosed rooms and spaces and that attention should be paid to smaller enclosed spaces such as maintenance cupboards, server rooms and storage areas where no ventilation may exist. On the basis of proximity, it is deemed this recommendation relates to the buildings within the civic amenity. The Tier 3 assessment also states that in the case of landfill gas levels rising then additional appropriate measures can be implemented.

Condition 3.1(h) requires the installation of continuous gas monitoring, gas vents and gas alarms in the on-site buildings. In addition, 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 all buildings constructed on the facility.

Having regard to the monitoring results submitted in support of the application for a certificate of authorisation, and the age of the closed landfill, the above remedial measures are considered appropriate and recommended in Condition 3.1. Additional remediation measures, also listed in Condition 3.1, include:

- Remove any waste resulting from remediation works, within 6 months of the date of grant of this Certificate of Authorisation or the date of generation from remediation works where applicable – Condition 3.1(a)(i);
- Requirement to minimise the disturbance of deposited waste to the extent possible – Condition 3.1(b); and
- Requirement to reseed grass within the site – Condition 3.1(k).

The proposed remedial measures are intended to break the SPR linkages by preventing:

- migration of landfill gas to on-site buildings and off-site; and
- migration of leachate into the aquifer and surface water bodies.

The recommended certificate of authorisation allows for the importation and use of soil and stone to complete the works.

Proposed aftercare monitoring and assessment:	Monitoring as specified in Condition 3.9 and Schedule A of the recommended certificate of authorisation. Validation report to be submitted within 30 months.
Adequacy of risk assessment:	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 and additional information received is adequate as it has identified, assessed and adequately addressed the associated risks inherent within the landfill site.

5. Appropriate Assessment

Appendix 1 lists the European Sites assessed, their associated qualifying interests and conservation objectives along with the assessment of the effects of the activity on the European Sites.

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 Lough Corrib SAC (site code: 000297), Lough Corrib SPA (site code: 004042) and Levally Lough SAC (site code: 000295).

That the activity is not directly connected with or necessary to the management of any European site and 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 is required. The reasons for this determination are as follows:

- There is a hydrological connection between the closed landfill and the Lough Corrib SAC (site code: 000297), via the adjacent surface water drainage system that discharges into the Killeelaun river (waterbody code: IE_WE_30C010800, segment code: 30_2244) to the north of the landfill, and the unnamed river (waterbody code: IE_WE_30C010800, segment code 30_2639) to the south of the landfill. The Killeelaun river and the unnamed river form parts of the Lough Corrib SAC (site code: 000297).
- There is a hydrological connection between the closed landfill and the Lough Corrib SPA (site code: 004042), via the Killeelaun River (waterbody code: IE_WE_30C010800, segment code: 30_2244) and the unnamed river (waterbody code: IE_WE_30C010800, segment code 30_2639), both of which discharge into the Clare river (waterbody code: IE_WE_30C010800) which forms part of the Lough Corrib SPA (site code: 004042).
- There is no hydrological connection between the closed landfill and the Levally Lough SAC (site code: 000295).

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 Lough Corrib SAC (site code: 000297), Lough Corrib SPA (site code: 004042) and Levally Lough SAC (site code: 000295), 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 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 Lough Corrib SAC (site code: 000297) and Lough Corrib SPA (site code: 004042) 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 Lough Corrib SAC (site code: 000297) and Lough Corrib SPA (site code: 004042); and
- There is no hydrological connection between the closed landfill and Levally Lough SAC (site code: 000295).

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: Lough Corrib SAC (site code: 000297), Lough Corrib SPA (site code: 004042) and Levally Lough SAC (site code: 000295).

6. Recommendation

This report has been prepared by Ewa Babiarczyk and Seán Byrne.

I recommend granting the certificate of authorisation as proposed.

Signed



Ewa Babiarczyk

Date 12th December 2023

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.

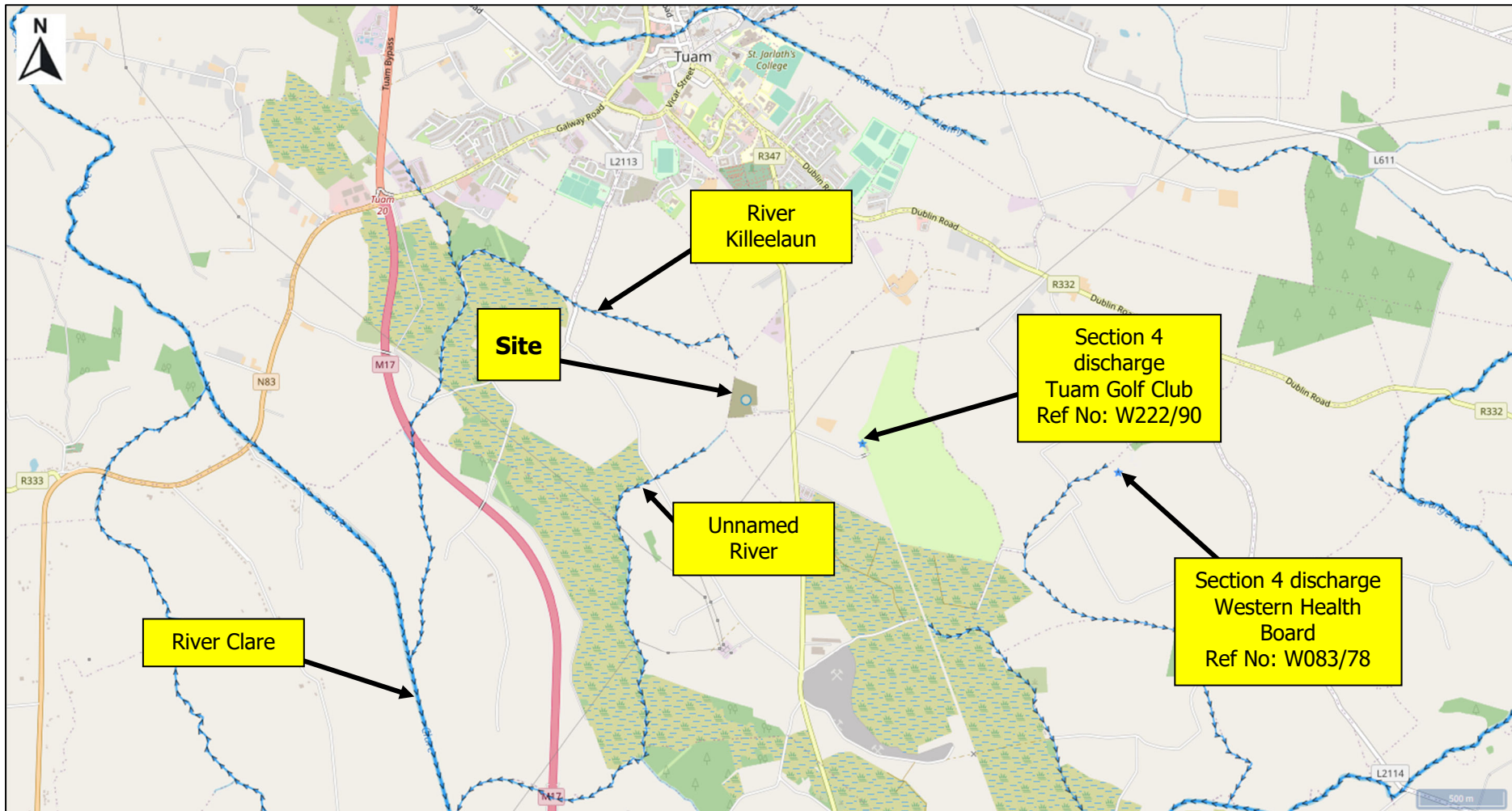


Figure 1: Location of Tuam Historic Landfill

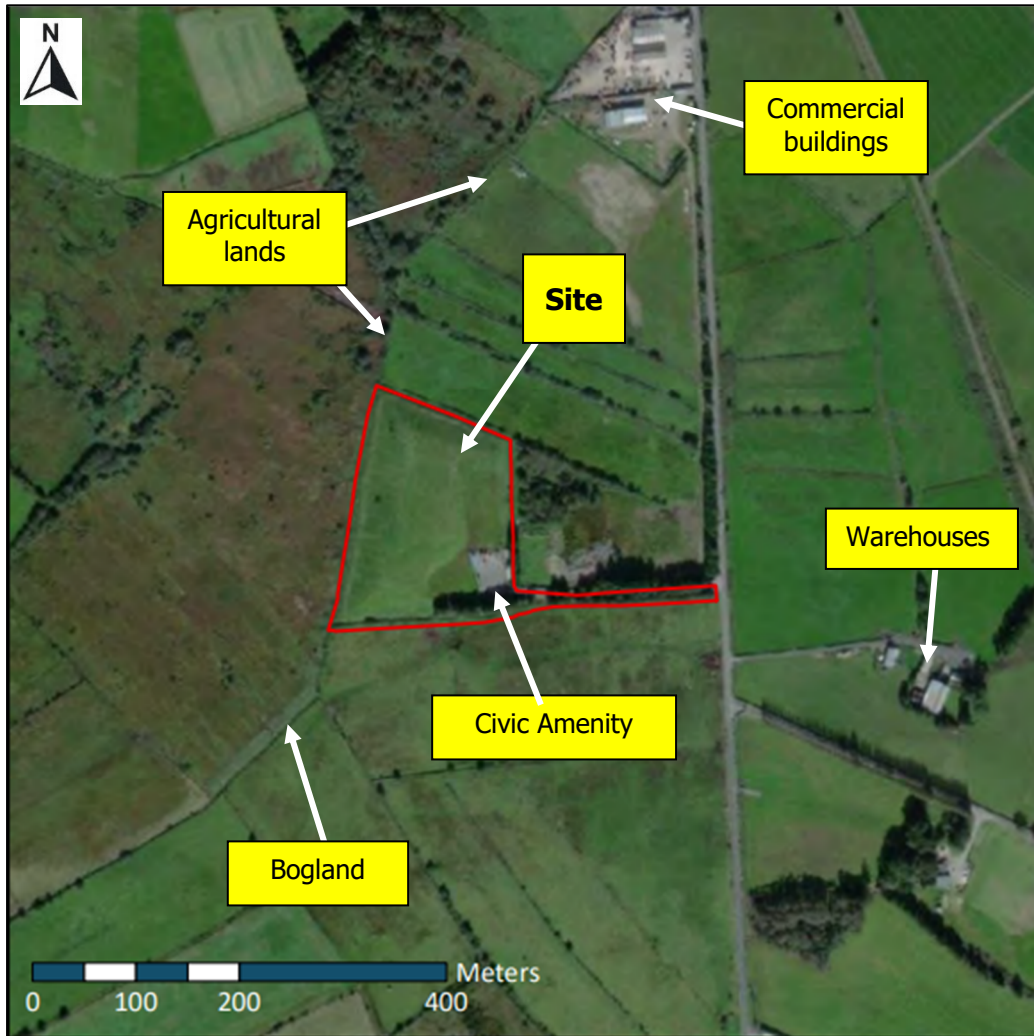


Figure 2: Surrounding area of the closed landfill site

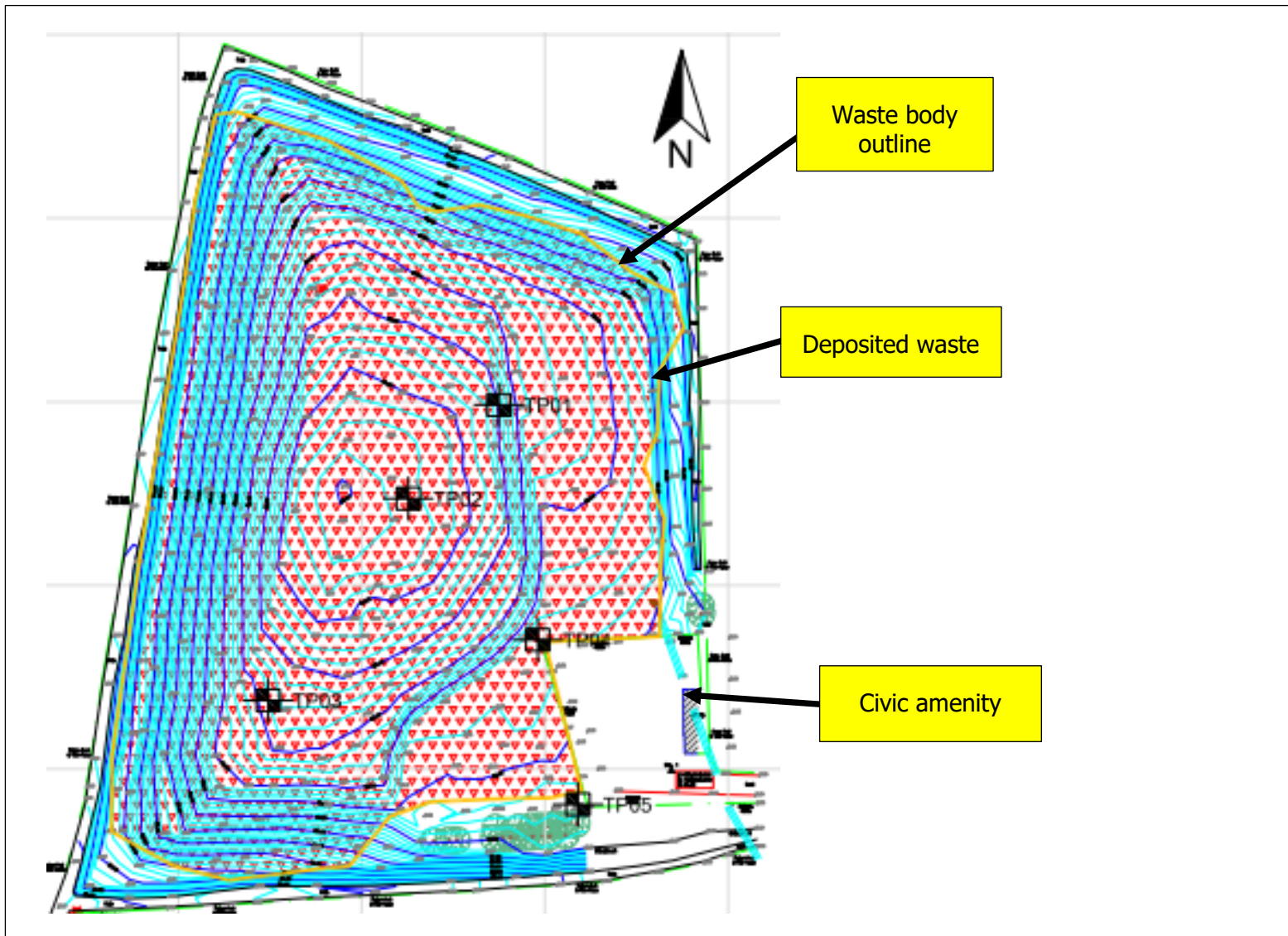


Figure 3: Extent of waste deposited



Figure 4: Exposed geocomposite clay liner (GCL)

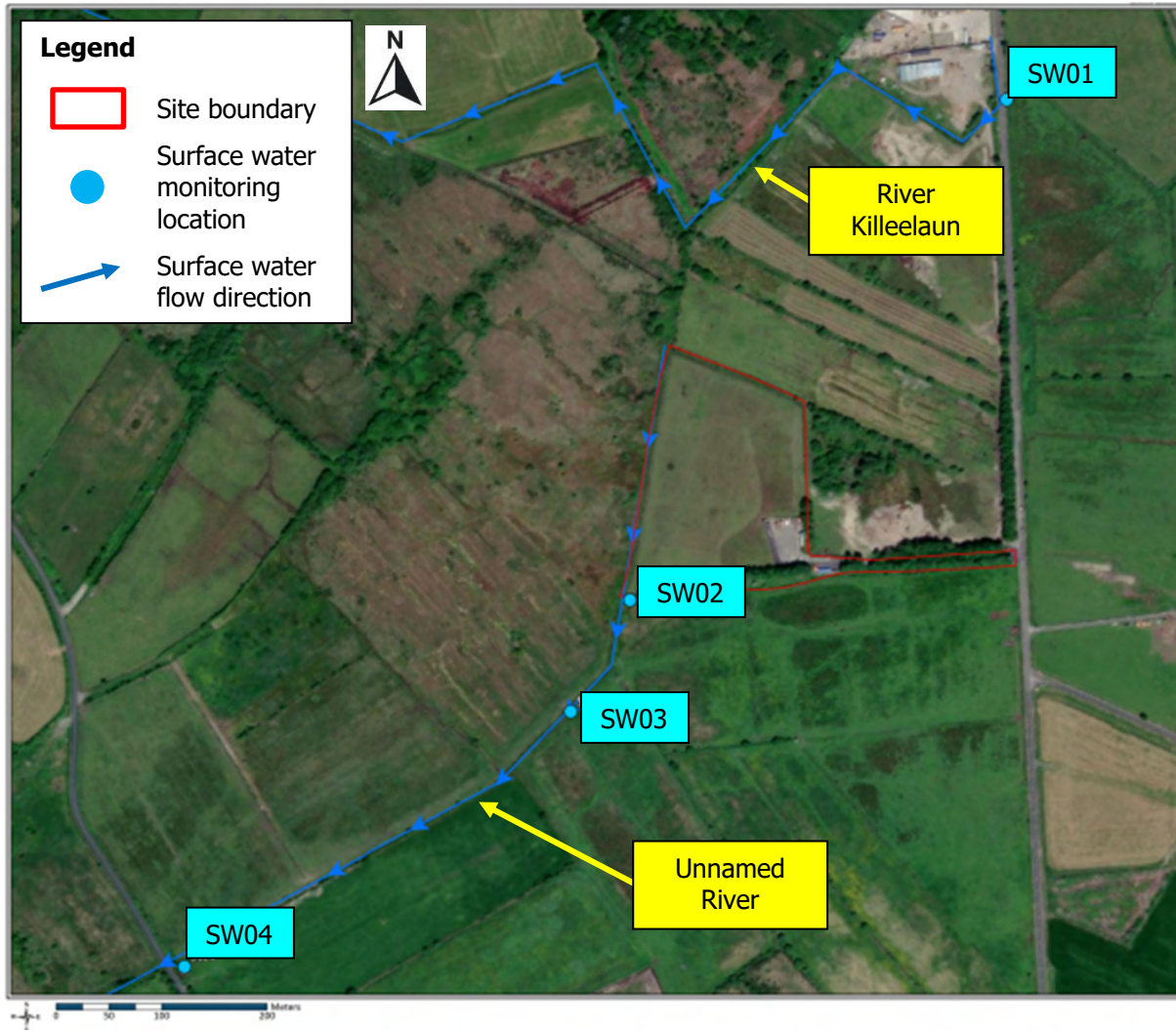


Figure 5: Surface water monitoring locations (SW)

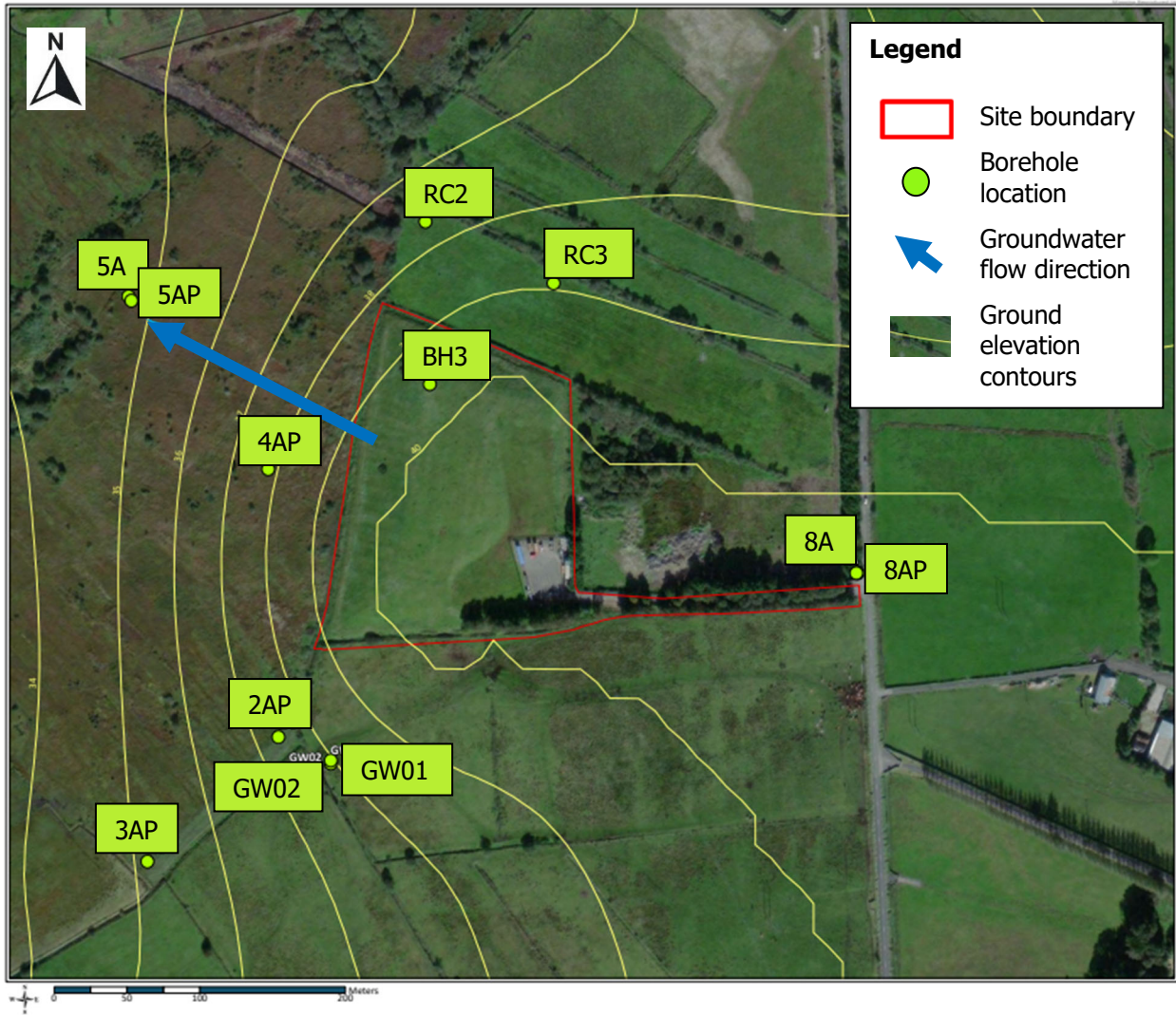


Figure 6: Groundwater flow direction and groundwater monitoring locations (GW, A, AP, RC)

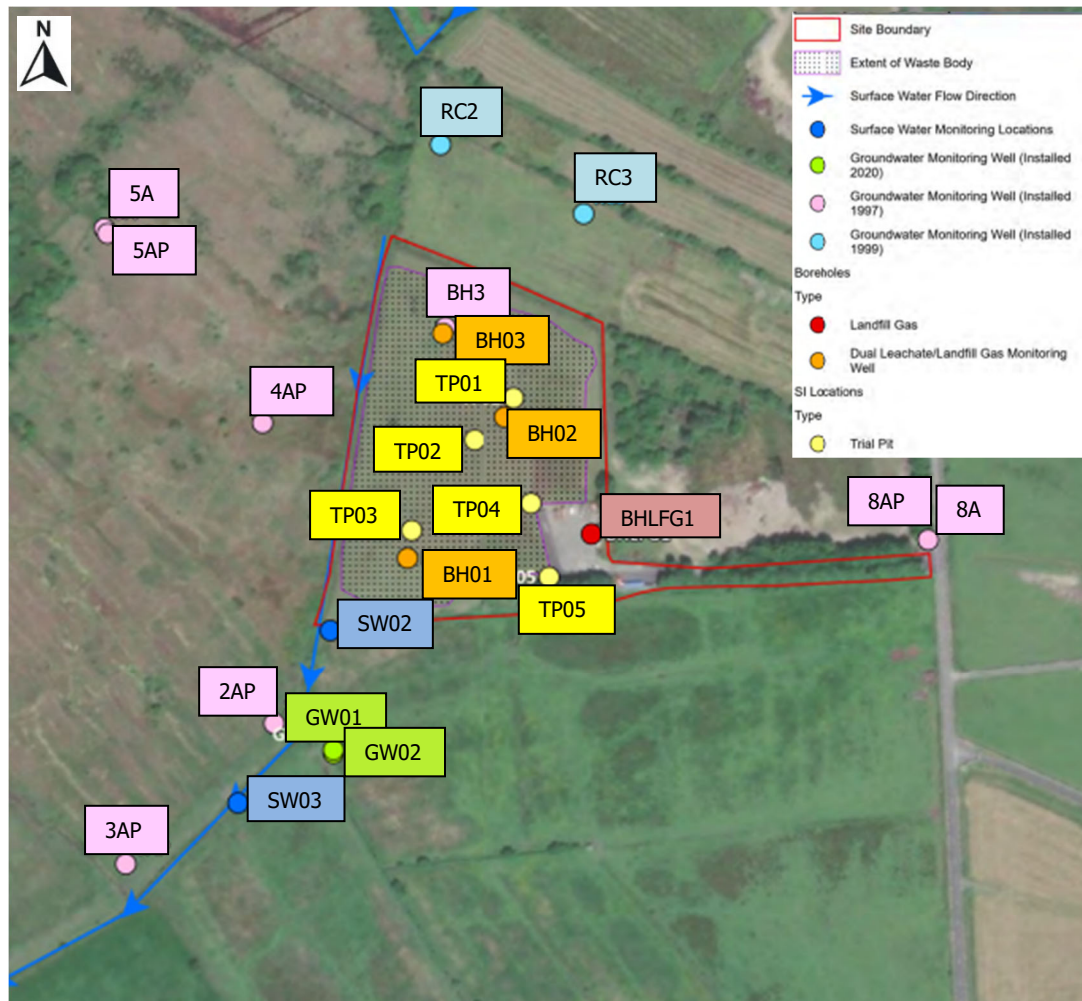


Figure 7: Trial pit (TP) and groundwater (A/AP/RC/BH/GW), dual gas & leachate (BH0), gas (BHLFG) and surface water (SW) monitoring locations

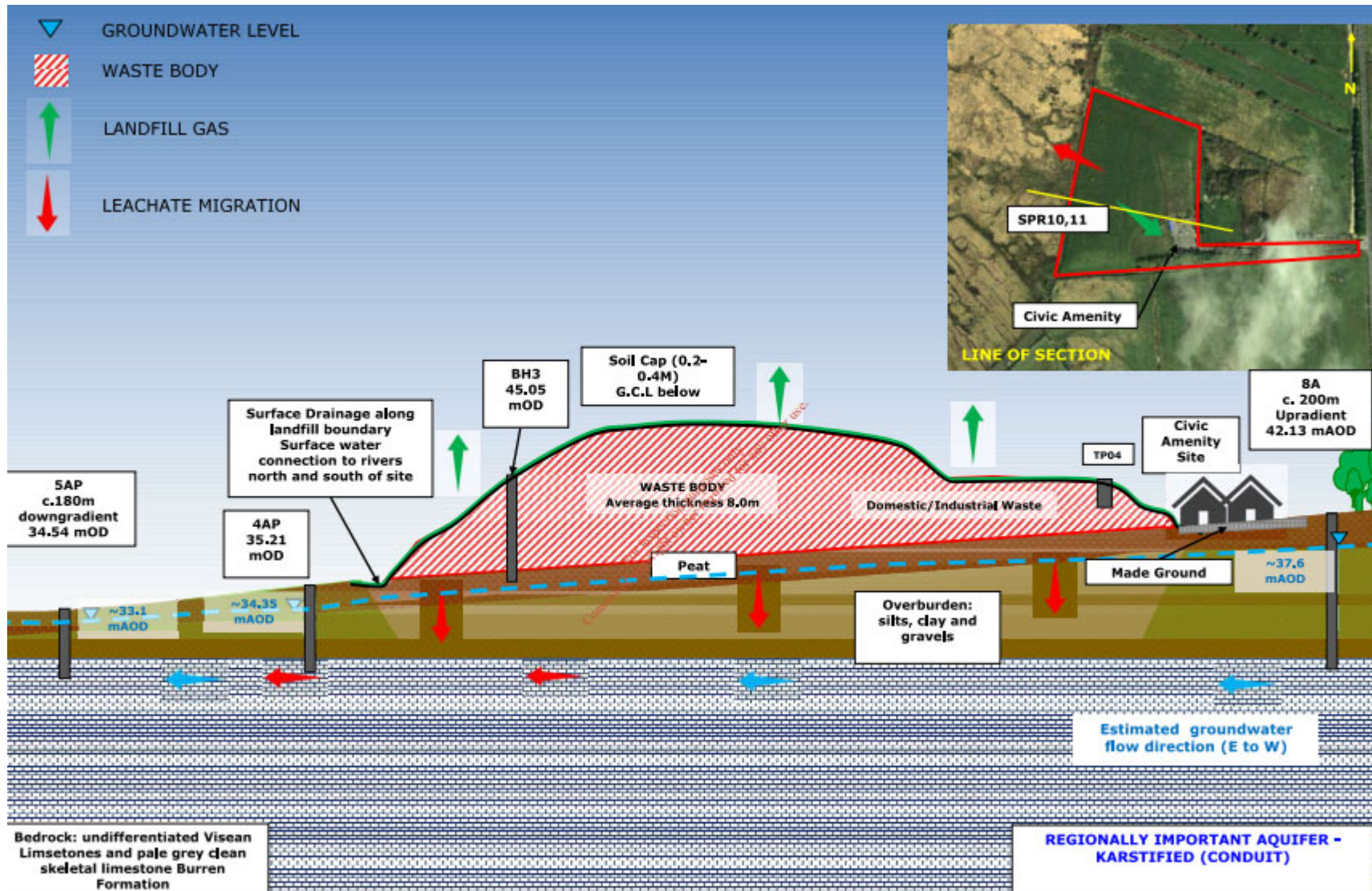


Figure 8: Conceptual site model for Tuam Historic Landfill

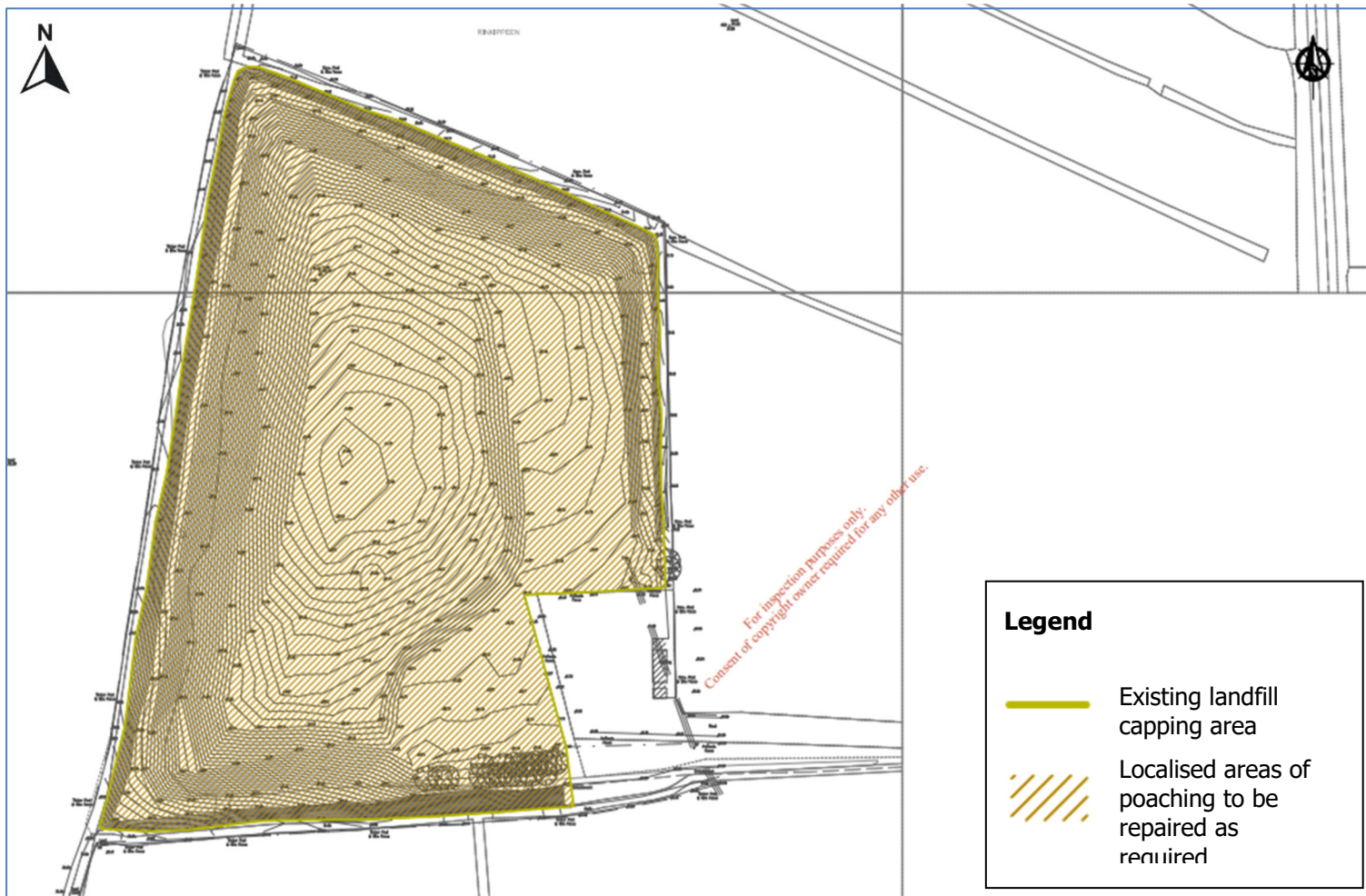


Figure 9: Area of the existing cap proposed to be repaired

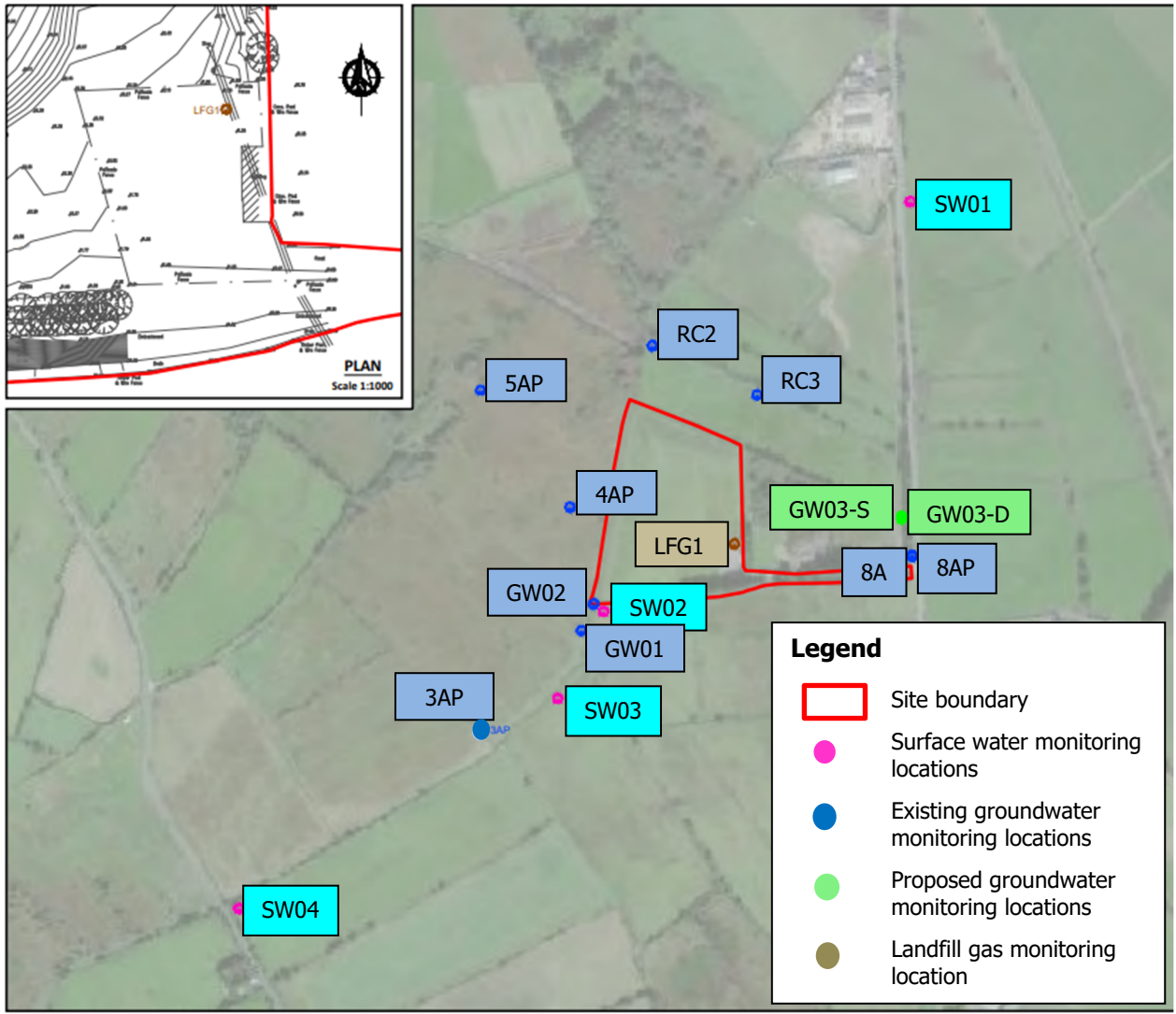


Figure 10: Existing and proposed monitoring locations

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

European Site	Direction from the facility (km)	Qualifying Interests (* denotes priority habitat)	Conservation Objectives	Assessment
Lough Corrib SAC (Site code: 000297)	2.1km south-east of the site.	<p>Species:</p> <p>[1029] Freshwater Pearl Mussel <i>Margaritifera margaritifera</i></p> <p>[1092] White-clawed Crayfish <i>Austropotamobius pallipes</i></p> <p>[1095] Sea Lamprey <i>Petromyzon marinus</i></p> <p>[1096] Brook Lamprey <i>Lampetra planeri</i></p> <p>[1106] Salmon <i>Salmo salar</i></p> <p>[1303] Lesser Horseshoe Bat <i>Rhinolophus hipposideros</i></p> <p>[1355] Otter <i>Lutra lutra</i></p> <p>[1393] Slender Green Feather-moss <i>Drepanocladus vernicosus</i></p> <p>[1833] Slender Naiad <i>Najas flexilis</i></p> <p>Habitats:</p> <p>[3110] Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)</p> <p>[3130] Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletalia uniflorae</i> and/or Isoeto-Nanojuncetea</p> <p>[3140] Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.</p>	NPWS (2017) Conservation Objectives: Lough Corrib [SAC 000297]. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. [dated 28 th April 2017]	<p>The main potential for impact on the Qualifying interests of this SAC would arise from changes in water and air quality, which could affect habitats and water-dependent species directly or indirectly.</p> <p>There is a potential risk from migration of landfill leachate into surface waters and groundwater and from migration of passive landfill gas into atmosphere.</p> <p>The recommended certificate of authorisation specifies conditions to protect the surface waters and groundwater and in turn the qualifying interests of this European Site.</p> <p>The capping, as required under Condition 3.1, will limit ingress of rainwater into the waste body thus limiting the generation of leachate.</p> <p>Condition 3.9 requires monitoring of leachate, groundwater upgradient and downgradient of the landfill and surface water upstream and downstream of the landfill.</p> <p>Additionally, Condition 3.1(d) requires installation, operation and maintenance of a gas management system to accommodate passive gas venting.</p> <p>Condition 3.9 and Schedule A require gas monitoring at the proposed gas vent and the existing gas monitoring borehole, and at the</p>

		<p>[3260] Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation</p> <p>[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites)</p> <p>[6410] <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)</p> <p>[7110] Active raised bogs*</p> <p>[7120] Degraded raised bogs still capable of natural regeneration</p> <p>[7150] Depressions on peat substrates of the <i>Rhynchosporion</i></p> <p>[7210] Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>*</p> <p>[7220] Petrifying springs with tufa formation (<i>Cratoneurion</i>)*</p> <p>[7230] Alkaline fens</p> <p>[8240] Limestone pavements*</p> <p>[91A0] Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles</p> <p>[91D0] Bog woodland*</p>		<p>relevant adjacent buildings, including domestic dwellings.</p> <p>Furthermore, Condition 3.3 requires that the closed landfill and the remedial works shall not cause environmental pollution or deterioration in the status of the receiving surface water body or groundwater body.</p> <p>In addition, Condition 3.14 requires that no emissions arising from activities carried on at the site, including, amongst others, leachate and gas, or litter and mud, shall result in an impairment of, or an interference with amenities or the environment beyond the facility boundary or any other legitimate uses of the environment beyond the facility boundary.</p> <p><i>Conclusion:</i></p> <p>The controls in the recommended certificate of authorisation will ensure that the activity will not negatively impact on water or air quality and that the qualifying interests of this European Site are protected.</p>
Lough Corrib SPA (Site code: 004042)	c.35km south-west of the site	<p>Species:</p> <p>[A051] Gadwell <i>Anas strepera</i></p> <p>[A056] Shoveler <i>Anas clypeata</i></p> <p>[A059] Pochard <i>Aythya ferina</i></p>	NPWS (2023) Conservation Objectives: Lough Corrib SPA 004042. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government	The main potential for impact on the Qualifying interests of this SPA would arise from disturbance to the habitat and from changes in water and air quality, which could affect habitats and water-dependent species.

		<p>[A061] Tufted Duck <i>Aythya fuligula</i> [A065] Common Scoter <i>Melanitta nigra</i> [A082] Hen Harrier <i>Circus cyaneus</i> [A125] Coot <i>Fulica atra</i> [A140] Golden Plover <i>Pluvialis apricaria</i> [A179] Black-headed Gull <i>Chroicocephalus ridibundus</i> [A182] Common Gull <i>Larus canus</i> [A193] Common Tern <i>Sterna hirundo</i> [A194] Arctic Tern <i>Sterna paradisaea</i> [A395] Greenland White-fronted Goose <i>Anser albifrons flavirostris</i></p> <p>Habitats: [A999] Wetlands</p>	<p>and Heritage [dated 27th January 2023]</p>	<p>The significant distance from the landfill to the SPA means there will be no negative impacts from the facility.</p> <p>Condition 3.3 requires that the closed landfill and the remedial works shall not cause environmental pollution or deterioration in the status of the receiving surface water body or groundwater body.</p> <p>In addition, Condition 3.14 requires that no emissions arising from activities carried on at the site, including, amongst others, leachate and gas, or litter and mud, shall result in an impairment of, or an interference with amenities or the environment beyond the facility boundary or any other legitimate uses of the environment beyond the facility boundary.</p> <p><i>Conclusion:</i> The controls in the recommended certificate of authorisation will ensure that the qualifying interests of this European site are protected.</p>
<p>Levally Lough SAC (Site code: 000295)</p>	<p>9.2km north-east of the site.</p>	<p>Habitats: [3180] Turloughs*</p>	<p>NPWS (2020) Conservation Objectives: Levally Lough SAC 000295. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage [dated 16th December 2020]</p>	<p>The main potential for impact on the Qualifying interests of this SAC would arise from disturbance to the habitat and from changes in water and air quality, which could affect the habitats.</p> <p>There is no hydrological connection between the closed landfill and the SAC. Also, the distance of 9.2km from the landfill to the SAC means there will be no negative impacts from the passive gas.</p> <p><i>Conclusion:</i> The controls in the recommended certificate of authorisation ensure the qualifying interests of this European site are protected.</p>