



**OFFICE OF ENVIRONMENTAL  
SUSTAINABILITY**

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

<b>TO:</b>	Eimear Cotter, Director
<b>FROM:</b>	Ewa Babiarczyk, Inspector, Environmental Licensing Programme
<b>DATE:</b>	4 <sup>th</sup> May 2021
<b>RE:</b>	Application by <b>Kildare County Council</b> for a Certificate of Authorisation for a closed landfill at <b>Greenhills, Athy, County Kildare</b> . Certificate of Authorisation Register Number <b>H0208-01</b> .

**1. Application details**

Type of facility:	Closed landfill as defined in the Regulations <sup>1</sup> .
Original site ownership	Kildare County Council.
Current site ownership	Kildare County Council.
Operator of closed landfill	Kildare County Council has operated this site since 1980.
Proposed use post remedial works	Kildare County Council intends to continue to use the site as its existing function as an open space grassed amenity and a sports and leisure facility.
Risk category of closed landfill:	Moderate risk (class B) due to <ul style="list-style-type: none"> <li>• migration of landfill leachate into groundwater and adjacent surface water body.</li> </ul>
Section 22 register number:	S22-02507
Grid Reference	268005 E and 194227 N
Application received:	9 <sup>th</sup> October 2020
AA screening determination:	14 <sup>th</sup> January 2021

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

Regulation 7(4) notice:	14 <sup>th</sup> January 2021
Additional information received:	Regulation 7(4) Reply received on 11 <sup>th</sup> February 2021. Two pieces of unsolicited information received on the same date, 1 <sup>st</sup> March 2021.
Name of Qualified Person:	Thomas Vainio-Mattila, Credentials provided by The Institute of Geologists of Ireland.
EPA site inspection:	No inspection was required.

## 2. Information on the closed landfill

Location of facility	The closed landfill is located in the centre of Athy town, County Kildare, 150m north of the N78 road.  The location of the landfill site is shown in Figure 1.
Period of landfilling	1980 to 1985.
Surrounding area	There are residential properties immediately adjacent to the western boundary of the site, as shown in Figure 2. The closest property is located 15m from the site boundary. A field with football pitches is located to the north of the site. The Barrow River flows immediately adjacent to the eastern boundary of the site. On the eastern bank of the Barrow River are residential properties and a school. A shopping centre and a car park adjoins the south-eastern boundary of the site.
Area of the closed landfill	The site covers an area of 4.1 ha.
Quantity of waste at the facility	Approximately 68,040 tonnes. 48,600 m <sup>3</sup>
Characterisation of waste deposited	The waste comprises municipal waste, construction & demolition (C&D) waste, commercial waste and industrial waste. The deposited waste includes brown gravelly clay / brown clay mixed with wood, concrete, cloths, black fibres, tiles, terram geotextile materials, bricks, metal, plastic, rubber plastic, bitumen, glass and styrofoam. Asbestos fibre bundles were also detected, as outlined below in Section titled <i>Leachate and water quality</i> .  The extent of the waste body is 1.62 ha. The waste was deposited in a few areas across the site as shown in Figure 3.

## 3. Site investigations

Current condition and appearance of closed landfill:	The site is mainly flat with a downward slope towards the Barrow River. In the past, a stream was traversing the site from west to north-east prior to discharge into the Barrow River. A sports and leisure facility and associated car park, as shown on Figure 2, were built in the location of this former stream. The site is largely grassed but there are also hardstanding areas associated within the sports
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	<p>and leisure facility. Boggy ground was observed towards the Barrow River during the site walkover on 13<sup>th</sup> November 2018.</p> <p>There are ESB Network services and an Irish Water water main crossing the site underground, as shown in Figure 2. It is not anticipated that any issues should occur in the event repairs are required to these services or the water main in the future, as repairs without excavation are possible for the underground pipework and 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"> <li>• The waste body is covered with a layer of 0.5m-1.1m thick brown slightly sandy gravelly clay;</li> <li>• The depth of waste is 6.7m below ground level (bgl);</li> <li>• The thickness of waste ranges from 0.2m to 5.6m with the thickest areas to the east and south of the sports and leisure facility;</li> <li>• The waste is underlain by sandy gravelly clay, silty clay and limestone bedrock.</li> <li>• Landfill leachate is being generated and is typical of leachate generated in an inert landfill; and</li> <li>• Landfill gas is being generated and is migrating outside the waste body.</li> </ul>
<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"> <li>• Walkover survey carried out on 13<sup>th</sup> November 2018;</li> <li>• Geophysical survey of the site was completed on 5<sup>th</sup> November 2018;</li> <li>• Trial pit investigation (five trial pits were excavated on 16<sup>th</sup> January 2019);</li> <li>• Soil sampling (three soil samples were collected from the trial pits TP3, TP4 and TP5. Analysis was carried out on 16<sup>th</sup> January 2019);</li> <li>• Permeability testing (one soil sample GW4 was tested on 9<sup>th</sup> April 2019);</li> <li>• Leachate monitoring (two rounds at three monitoring wells were carried out on 23<sup>rd</sup> April 2019 and 8<sup>th</sup> May 2019);</li> <li>• Landfill gas monitoring (four rounds at six monitoring wells were carried out on 23<sup>rd</sup> April 2019, 25<sup>th</sup> April 2019, 8<sup>th</sup> May 2019 and 29<sup>th</sup> May 2019);</li> <li>• Groundwater monitoring (two rounds at three monitoring wells were carried out on 23<sup>rd</sup> April 2019 and 8<sup>th</sup> May 2019);</li> <li>• Surface water monitoring (two rounds at two monitoring locations were carried out on 23<sup>rd</sup> April 2019 and 9<sup>th</sup> May 2019);</li> </ul>

	<ul style="list-style-type: none"> <li>• Topographical survey was carried out 26<sup>th</sup> April 2019;</li> <li>• Outdoor surface volatile organic compounds (VOC) emissions survey was carried out at 42 locations within and outside the site on 29<sup>th</sup> May 2019; and</li> <li>• Indoor VOC emissions monitoring was undertaken at 58 locations within the sports and leisure facility on 19<sup>th</sup> December 2019.</li> </ul>																		
Hydrology	<p>The closed landfill is located within the catchment of the Barrow River (Catchment Identification Number: 14).</p> <p>The Barrow River (waterbody code: IE_SE_14B011600) flows in a southerly direction along the eastern site boundary of the site, as shown in Figure 1. The Athy Stream (waterbody code: IE_SE_14A060600), also known as the Moneen River, discharges into the Barrow River 35m east of the south-eastern boundary of the site. Grand Canal flows 360m south-west of the site and joins the Barrow River 630m downstream of the landfill.</p> <p>There is no Water Framework Directive (WFD) status assigned to the Barrow River adjacent to the site. However, 3.7km upstream of the landfill the WFD status of the Barrow River is classified as Good and 1.6km downstream of the closed landfill, the WFD status of the Barrow River (waterbody code: IE_SE_14B011900) is classified as Poor. Agriculture and hydromorphology are identified as the only significant pressures contributing to the poor ecological status. Therefore, the drop in the WFD status indicates that the identified factors, and not the closed landfill, are impacting the water quality.</p> <p>Two rounds of surface water monitoring were carried out on the Barrow River on 23<sup>rd</sup> April 2019 and 9<sup>th</sup> May 2019. The monitoring was conducted 80m upstream of the site at location SW1 and 55m downstream of the closed landfill at location SW2, as shown in Figure 4.</p> <p>Table below shows the maximum parameter concentrations recorded during both monitoring rounds.</p> <table border="1" data-bbox="581 1413 1406 1759"> <thead> <tr> <th rowspan="2">Parameter</th> <th rowspan="2">EQS <sup>1</sup></th> <th colspan="2">Measured concentrations <sup>2</sup></th> </tr> <tr> <th>Upstream Location SW1</th> <th>Downstream location SW2</th> </tr> </thead> <tbody> <tr> <td>Dissolved oxygen (lower limit) [%]</td> <td>Above 80% saturation</td> <td>100</td> <td>100</td> </tr> <tr> <td>BOD [mg/l]</td> <td>2.2</td> <td>1</td> <td>1</td> </tr> <tr> <td>Ammoniacal Nitrogen as N [mg/l]</td> <td>0.090</td> <td>&lt;0.03</td> <td>0.03</td> </tr> </tbody> </table>	Parameter	EQS <sup>1</sup>	Measured concentrations <sup>2</sup>		Upstream Location SW1	Downstream location SW2	Dissolved oxygen (lower limit) [%]	Above 80% saturation	100	100	BOD [mg/l]	2.2	1	1	Ammoniacal Nitrogen as N [mg/l]	0.090	<0.03	0.03
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<sup>1</sup> Environmental Quality Standard (EQS); 95% high status/ Annual average EQS (AA-EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

<sup>2</sup> Monitoring results as stated in Table 5: *Surface Water Analytical Results* of the Risk Assessment.

Molybdate Reactive Phosphate as P [mg/l]	0.045	<0.03	<0.03
Fluoride [mg/l]	1.5	<0.3	<0.3
Cyanide [µg/l]	10	<0.01	<0.01
Arsenic [µg/l]	20	<2.5	<2.5
Chromium [µg/l]	0.6	<b>&lt;1.5</b>	<b>&lt;1.5</b>
Copper [µg/l]	5	<b>&lt;7</b>	<b>&lt;7</b>
Cadmium [µg/l]	0.2	<b>&lt;0.5</b>	<b>&lt;0.5</b>
Mercury [µg/l]	0.07	<b>&lt;1</b>	<b>&lt;1</b>
Tributyltin [µg/l]	0.0002	<b>&lt;0.1</b>	<b>&lt;0.1</b>
Chloride [mg/l]	-	26.50	<b>26.70</b>
Total Oxidised Nitrogen as N [mg/l]	-	3.50	<b>3.70</b>
Total Alkalinity as CaCO <sub>3</sub> [mg/l]	-	282	<b>302</b>
Boron [µg/l]	-	23	<b>27</b>
Calcium [mg/l]	-	123.90	<b>125.50</b>
Iron [µg/l]	-	57	<b>59</b>
Magnesium [mg/l]	-	11.1	<b>11.3</b>
Manganese [µg/l]	-	28	<b>29</b>
Potassium [mg/l]	-	2.2	<b>2.3</b>
Sodium [mg/l]	-	12.4	<b>12.6</b>
Fluoranthene [µg/l]	0.0063	<b>&lt;0.5</b>	<b>&lt;0.5</b>
Benzo(bk)fluoranthene [µg/l]	0.017	<b>&lt;1</b>	<b>&lt;1</b>
Benzo(ghi)perylene [µg/l]	0.0082	<b>&lt;0.5</b>	<b>&lt;0.5</b>
<p>The monitoring results show that most of the monitored parameters were within their environmental quality standards (EQS) set out in <i>European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended</i>. It is noted however, that it cannot be determined whether the actual concentrations for Chromium, Copper, Cadmium, Mercury, Tributyltin and PAHs including, but not limited to, fluoranthene, benzo(bk)fluoranthene and benzo(ghi)perylene, were within the relevant standards as the limit of detection for the monitoring methods was above the EQS. Furthermore, the monitoring results show that the downstream concentrations of a number of parameters slightly exceed the upstream concentrations, thus showing that the landfill is not having a significant impact on downstream water quality.</p>			

	<p>There are a number of discharges into the Barrow River between the closed landfill and the monitoring location of the Poor WFD status, 1.6km downstream of the closed landfill. These include two Section 4 trade effluent discharge points located 780m and 825m downstream of the closed landfill, one primary discharge and six storm water overflows from a wastewater treatment plant which serves the Athy Agglomeration (Licence Reg. No. D0003-01).</p> <p>Condition 3.8(d) requires monitoring of surface water upstream and downstream of the closed landfill on a quarterly basis and specifies the minimum parameters to be monitored. Also, Condition 3.8(f) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant trigger levels and/or standard reference values.</p>
Hydrogeology	<p>The closed landfill lies within the Athy-Bagnelstown Gravels groundwater body (GWB Number: IE_SE_G_160). The status of this groundwater body is good. The site is underlain by a bedrock aquifer which is classified as a Regionally Important Aquifer - Karstified (diffuse; Rkd) and Regionally important gravel aquifer (Rg). The aquifer vulnerability beneath the site is Moderate. Groundwater beneath the site flows towards the east/ north-east towards the Barrow River, as shown in Figure 5.</p> <p>The closed landfill is located within the Inner Protection Area (SI) of the Groundwater Source Protection Zone for Athy Town Council Public Water Supply (PWS). Two Athy Town Council's drinking water boreholes (abstraction Id: 1400PUB1050_3 and 1400PUB1050_2) are located, respectively, 56m and 117m north of the site. An associated infiltration gallery is located 260m north of the site (abstraction Id. 1400PUB1050_1). The two boreholes and the infiltration gallery are however no longer in use, with water for Athy instead sourced from the Srowland Water Treatment Plant approximately 2.6km upstream of the closed landfill.</p> <p>The nearest active groundwater public water supply (abstraction Id: 1400PUB1010_1) is located 2.3km west/ west-south of the site at the Castlemitchell Quarry. 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 PWS.</p> <p>There are a number of private water boreholes in all directions from the closed landfill. Due to the fact that groundwater beneath the site flows towards the east/ north-east and into the Barrow River, there may be a potential impact to boreholes located east of the river. However, the appropriate capping will limit ingress of rainwater into the waste body thus limiting the generation of leachate. Condition 3.8(e) requires monitoring of groundwater quality upgradient and downgradient of the waste body and specifies the minimum parameters to be monitored.</p>

<p>Leachate and water quality:</p>	<p><u>Trial pit investigation</u></p> <p>Five trial pits TP1 to TP5 were excavated on 16<sup>th</sup> January 2019, as shown in Figure 6. Waste was encountered in all five trial pits. The sub-surface profile encountered in the trial pits consisted of a cover material comprised of brown gravelly clay / brown clay, with a thickness ranging from 0.5m to 1.1m overlaying a 1.1 to 4.4m thick layer of brown gravelly clay/ brown clay mixed with plastic, metal, terram geotextile materials, bricks, clothes and wood.</p> <p><u>Soil sampling</u></p> <p>Soil samples were collected from the trial pits TP3, TP4 and TP5. The sampling detected the presence of total organic carbon (TOC), sulphide and elemental sulphur, metals, polycyclic aromatic hydrocarbons (PAHs), mineral oil, petroleum hydrocarbons, polychlorinated biphenyls (PCBs) and phenols. The sampling also detected chrysotile (white asbestos) fibre bundles at concentrations of less than 0.001% in samples from trial pits TP4 and TP5. The Tier 3 Assessment states that asbestos in such low concentrations poses no risk to human health or the surrounding environment considering the use of site. The soil sampling further showed that the relevant parameters, which include TOC, BTEX (benzene, toluene, ethylbenzene and xylenes), PCBs (7 congeners), mineral oil (C10-C40) and PAH 17 Total, were within the inert waste limit values, as set in 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>.</p> <p><u>Leachate</u></p> <p>The applicant carried out leachate testing on the soil samples from trial pits TP3, TP4 and TP5 on 16<sup>th</sup> January 2019. The testing included dissolved antimony, arsenic, barium, boron, cadmium, chromium, copper, lead, molybdenum, nickel, selenium, zinc and mercury, total phenols, fluoride, ammoniacal nitrogen, sulphate, chloride, dissolved organic carbon and total dissolved solids. The leachate testing result showed that the concentrations of the tested parameters were within the leaching limit values for inert waste, as set out in the above Waste Acceptance Criteria. Accordingly, the landfill leachate is typical of leachate generated in an inert landfill.</p> <p>Leachate monitoring was carried out at combined monitoring wells L1, L2 and L3 within the waste body, as shown in Figure 6, on 23<sup>rd</sup> April 2019 and 8<sup>th</sup> May 2019. The monitoring well L2 was dry during both monitoring events therefore, leachate samples were only retrieved from wells L1 and L3. It is also noted that monitoring well L2 is not located within the waste body when Figure 3, which shows the waste locations, is cross-referenced with the monitoring well locations in Figure 6. Accordingly, Condition 3.7 requires a drawing showing, among other elements, the interpolated extent of the waste body and all monitoring points.</p> <p>Table below shows the parameter concentrations which exceed the relevant standards.</p>
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Parameter	Limit / EQS <sup>1,2,3</sup>	Measured concentrations <sup>4</sup>	
		L1	L3
Electrical Conductivity (EC) [ $\mu$ S/cm]	1,875 <sup>1</sup>	1,509	<b>2,078</b>
Sulphate [mg/l]	187.5 <sup>1</sup>	<b>212.50</b>	46.00
Ammoniacal Nitrogen [mg/l]	0.065 <sup>1</sup>	<b>6.06</b>	<b>40.56</b>
BOD [mg/l]	2.2 <sup>2</sup>	<b>16</b>	<b>24</b>
Iron [ $\mu$ g/l]	200 <sup>3</sup>	<20	<b>332</b>
Manganese [ $\mu$ g/l]	50 <sup>3</sup>	<b>3,546</b>	<b>2,425</b>
Fluoranthene [ $\mu$ g/l]	0.0063 <sup>2</sup>	<b>1.7</b>	<b>17.4</b>
Benzo(bk)fluoranthene [ $\mu$ g/l]	0.075 <sup>1</sup>	<b>2</b>	<b>22</b>
Benzo(ghi)perylene [ $\mu$ g/l]	0.075 <sup>1</sup>	<b>0.8</b>	<b>10.5</b>

The monitoring results also show elevated PAHs including, but not limited to, fluoranthene, benzo(bk)fluoranthene and benzo(ghi)perylene in the landfill leachate. PAHs were also detected in surface water and groundwater, however, as previously outlined in the Hydrology section, it cannot be determined whether the actual concentrations of PAHs in surface water and groundwater were within the relevant EQSs, as the limit of detection for the monitoring method is above the EQSs.

Condition 3.8(b) requires leachate monitoring in the existing wells L1, L2 and L3 on a quarterly basis and specifies the minimum parameters to be monitored, including PAHs, to ensure that the ongoing levels are monitored. Also, Condition 3.9 provides for monitoring of additional parameters, such as PAHs if required in groundwater and surface water, if increases in PAH levels are observed in the leachate.

#### Groundwater quality

Groundwater monitoring was carried out at three groundwater monitoring wells GW1, GW2 and GW3, as shown in Figure 6, on 23<sup>rd</sup> April 2019 and 8<sup>th</sup> May 2019.

Considering that groundwater flows towards east/ north-east, it is noted that only one of the monitoring wells (GW1) is located downgradient of the waste body. It is noted however, that GW1 is

<sup>1</sup> European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

<sup>2</sup> Environmental Quality Standard (EQS); 95% high status/ annual average value, as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

<sup>3</sup> European Union (Drinking Water) Regulations 2014, S.I. 122 of 2014.

<sup>4</sup> Monitoring results as stated in Table 4: *Leachate Analytical Results* of the Risk Assessment.



located at the north-eastern corner of the site and the waste was mainly deposited in other parts of the site, as shown in Figure 3. Therefore, it is considered that the monitoring results from GW1 are not fully representative of groundwater conditions downgradient of the site. Accordingly, Condition 3.1(d) requires installation of at least one additional groundwater monitoring well downgradient of the waste body.

Notwithstanding the above observation, the table below is based on both monitoring rounds and shows the parameters which exceeded the relevant standards/limits and the parameters for which no exceedances were recorded but their downgradient concentrations exceeded the upgradient concentrations.

Parameter	EQS/ Limit 1,2,3	Measured concentrations <sup>4</sup>	
		Upgradient location GW3	Downgradient location GW1
Faecal Coliforms [Cfu/100ml]	0 <sup>1</sup>	<b>1</b>	<b>48</b>
Total Coliforms [Cfu/100ml]	0 <sup>1</sup>	<b>79.8</b>	<b>1,090</b>
Dissolved calcium [mg/l]	200 <sup>2</sup>	111	119.8
Ammoniacal nitrogen as N [mg/l]	0.065 <sup>1</sup>	0.04	0.05
Fluoranthene [µg/l]	0.075 <sup>1,5</sup>	<b>&lt;0.5</b>	<b>&lt;0.5</b>
Benzo(bk)fluoranthene [µg/l]	0.075 <sup>1,4</sup>	<b>&lt;1</b>	<b>&lt;1</b>
Benzo(ghi)perylene [µg/l]	0.075 <sup>1,4</sup>	<b>&lt;0.5</b>	<b>&lt;0.5</b>

The above monitoring results show that the landfill is impacting groundwater quality, however with the exception of faecal and total coliforms, the impact on groundwater quality is not considered to be significant. The exceedances of faecal and total coliforms at the upgradient monitoring location may indicate that groundwater quality is also impacted by factors other than the landfill. It is also noted that, similarly to surface water monitoring results, it cannot be determined whether the actual concentrations for PAHs including, but not limited to, fluoranthene, benzo(bk)fluoranthene and benzo(ghi)perylene, were within the relevant standards as the limit of detection for the monitoring method is above the EQS.

<sup>1</sup> European Union (Drinking Water) Regulations 2014, S.I. 122 of 2014.

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

<sup>3</sup> Sum of Total Polycyclic Aromatic Hydrocarbons, as set out in Schedule 5 of European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016.

<sup>4</sup> Monitoring results as stated in Table 3: *Groundwater Analytical Results of the Risk Assessment*.

	<p>Condition 3.8(e) requires monitoring on a quarterly basis of groundwater from the existing wells and at least one additional groundwater monitoring well, which shall be downgradient of the waste body. Also, Condition 3.8(f) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant trigger levels and/or standard reference values.</p>																												
<p>Landfill gas:</p>	<p>There is a risk of landfill gas migration to on-site and off-site buildings. The most likely pathway for the migration of the landfill gas is through the underlying bedrock and existing landfill cover material.</p> <p>Gas monitoring was carried out on 23<sup>rd</sup> April 2019, 25<sup>th</sup> April 2019, 8<sup>th</sup> May 2019 and 29<sup>th</sup> May 2019. In total six wells L1, L2, L3 and GW1, GW2 and GW3, as shown in Figure 6, were monitored. The monitored parameters were methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), oxygen (O<sub>2</sub>), carbon monoxide (CO) and hydrogen sulphide (H<sub>2</sub>S). Also, gas flow rate was measured.</p> <p>The below table shows the maximum concentrations of methane and carbon dioxide measured at on-site locations shown in Figure 6. For ease of reading, the monitoring locations outside the waste body are highlighted orange.</p> <table border="1" data-bbox="565 949 1360 1623"> <thead> <tr> <th>Well symbol</th> <th>Location description</th> <th>Methane (v/v %)</th> <th>Carbon dioxide (% v/v)</th> </tr> </thead> <tbody> <tr> <td>L1</td> <td>15m from the on-site building</td> <td><b>3.2</b></td> <td><b>11.6</b></td> </tr> <tr> <td>L2</td> <td>20m to the east from the pitch</td> <td>0.1</td> <td><b>12.7</b></td> </tr> <tr> <td>L3</td> <td>60m south of the building</td> <td><b>20.4</b></td> <td><b>12</b></td> </tr> <tr> <td>GW1</td> <td>At the north-eastern corner of the site</td> <td><b>1.9</b></td> <td>0.1</td> </tr> <tr> <td>GW2</td> <td>At the south-western corner of the site</td> <td>0.1</td> <td><b>3.5</b></td> </tr> <tr> <td>GW3</td> <td>At the north-western corner of the site</td> <td>0.1</td> <td>0.2</td> </tr> </tbody> </table> <p>The monitoring results show that low levels of landfill gas are being generated within the waste body and migrating to locations outside the waste body. Monitoring results show that the maximum gas flow rate was recorded at well GW2 at 0.2 l/h.</p> <p><u>VOC monitoring</u></p> <p>Volatile organic compounds (VOC) emission monitoring was carried out at 42 locations within and outside the site on 29<sup>th</sup> May 2019. The</p>	Well symbol	Location description	Methane (v/v %)	Carbon dioxide (% v/v)	L1	15m from the on-site building	<b>3.2</b>	<b>11.6</b>	L2	20m to the east from the pitch	0.1	<b>12.7</b>	L3	60m south of the building	<b>20.4</b>	<b>12</b>	GW1	At the north-eastern corner of the site	<b>1.9</b>	0.1	GW2	At the south-western corner of the site	0.1	<b>3.5</b>	GW3	At the north-western corner of the site	0.1	0.2
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GW2	At the south-western corner of the site	0.1	<b>3.5</b>																										
GW3	At the north-western corner of the site	0.1	0.2																										

	<p>Risk Assessment stats that no elevated VOCs were detected at any of the locations monitored.</p> <p>The indoor VOC emissions survey of the sports and leisure facility was undertaken on the 19<sup>th</sup> December 2019. The monitoring results show that the highest level of VOCs was recorded at 40ppm in the staff-only kitchen. The risk assessment states that a combination of chlorine in the facility's swimming pool and cleaning products had an impact on the VOC readings at some of the locations. The risk assessment further states however, that the observed VOC readings at all surveyed areas are considered to be within the typical background concentration range.</p> <p>The applicant, in correspondence dated 10<sup>th</sup> February 2021, states that the very low gas flow rates observed, and the results of the VOC monitoring demonstrated that "the imported material is not actively generating landfill gas and it is therefore not migrating vertically or laterally, and hence would not affect any potential receptors (on or off-site)." It is considered however, that the methane and carbon dioxide concentrations observed within the waste body and especially at monitoring location L3 are high and, despite the very low gas flow rates measured, the generated gas constitutes a risk to human receptors. Also, as set out in the Agency Landfill Manuals - Landfill Monitoring, 2<sup>nd</sup> Edition, 2003, the trigger levels for monitoring emissions of methane and carbon dioxide 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 exceeded at GW1 in respect of methane and at GW2 in respect of carbon dioxide.</p> <p>Accordingly, Condition 3.1(c) requires a gas management system, as outlined below in Section titled <i>Proposed Remedial Actions</i>. In addition, Condition 3.8(c) also requires gas monitoring to detect the presence and concentration of landfill gas on a quarterly basis. Additionally, Condition 3.1(f) requires installation of gas vents and gas alarms in the on-site buildings and Condition 3.1(g) 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 the on-site buildings.</p>
<p>Conceptual site model:</p>	<p>Tier 1 Assessment determined that the overall risk score for the closed landfill was High (Class A). This classification was due to the close proximity of the Barrow River, the risk of leachate migration into surface waters and protected areas (SWDTE) and the risk of landfill gas migration to off-site human receptors.</p> <p>Following Tier 2 and Tier 3 investigations this risk classification was reduced to Moderate (Class B) due to the risk of leachate migration, via groundwater, into public water supplies and private drinking water wells, Groundwater Protected Areas (GWDTE), aquifer and surface water.</p> <p>The conceptual site model is shown in Figure 7.</p>

#### 4. SPR linkages and remedial actions

<p>SPR linkage scenarios (applicable ones only):</p>	<p><b>Leachate and gas migration scores:</b></p> <p><u>High scores:</u> There are no pathways identified as High Risk.</p> <p><u>Moderate scores:</u> Five pathways were identified as Moderate Risk:</p> <ul style="list-style-type: none"> <li>• Migration of leachate to private wells (SPR 3);</li> <li>• Migration of leachate into Groundwater Protected Areas (GWDTE) (SPR4);</li> <li>• Migration of leachate to the underlying aquifer (SPR 5);</li> <li>• Migration of leachate to public water supplies (SPR 6); and</li> <li>• Migration of leachate, via groundwater migration, to surface water bodies (SPR 7).</li> </ul> <p><u>Low scores:</u> Four pathways were identified in Tier 2 Assessment as Low Risk:</p> <ul style="list-style-type: none"> <li>• Migration of leachate, via groundwater flowing to water drainage/runoff, into surface waterbodies (SPR 1);</li> <li>• Migration of leachate, via groundwater, to Surface Water Body Protected Areas (SWDTE) (SPR 2);</li> <li>• Human health exposure pathway of off-site lateral migration of landfill gas into nearby buildings (SPR 10); and</li> <li>• Vertical landfill gas migration (SPR 11).</li> </ul> <p><b>Summary:</b> Upon the review of the monitoring data;</p> <ul style="list-style-type: none"> <li>• remedial action is warranted to address the risk of leachate migrating from the site into groundwater and surface water.</li> <li>• remedial action is warranted to address the risk of migration of landfill gas to on-site buildings and off-site locations.</li> </ul>
<p>Proposed remedial actions:</p>	<p>No remedial measures, other than using the existing cover material as the landfill cap, were proposed by the applicant. The Tier 3 Assessment states that “the site, in its current status, does not require any further actions, hence no remedial measures are proposed”.</p> <p>The applicant in the correspondence dated 10<sup>th</sup> February 2021 stated that the existing cover material was identified as a 0.5m to 1.1m thick brown slightly sandy gravelly clay. One undisturbed sample GW04, as shown in Figure 6, was collected from the cover layer on 9<sup>th</sup> April 2019 and sent for permeability testing. The sample was classified as a brown slightly sandy gravelly clay at a depth of 0.45mbg and a permeability of <math>2.3 \times 10^{-8} \text{m/s}</math>. The applicant states that the low permeability of this material will impede rainfall infiltration and therefore reduce the generation of leachate.</p>

However, due to the fact that leachate is being generated, it is considered that the rainwater ingress is not prevented by the existing cover material and therefore, a cover material of a lesser permeability is required. Accordingly, Condition 3.1(b) requires a landfill cap that comprises of a minimum 1m thick mineral layer having a hydraulic conductivity of less than or equal to  $1 \times 10^{-9} \text{m/s}$  or a 1mm thick geomembrane, or equivalent, to achieve the hydraulic conductivity of  $1 \times 10^{-9} \text{m/s}$ . In addition, Condition 3.1(b) requires that the cap is placed over all areas where waste is deposited with the exception of the hardstanding areas.

Also, the measured landfill gas levels, as described above, indicate there are localised pockets of landfill gas across the site. Therefore, it is considered that gas vents are required in all areas where waste is deposited. Condition 3.1(c) requires that spacing between the gas vent pipes shall be in accordance with the EPA Landfill Manuals – Landfill Site Design.

Condition 3.7 requires a drawing showing the interpolated extent of the waste body, the areas capped in accordance with Condition 3.1(b) and the gas vents installed in accordance with Condition 3.1(c).

Having regard to the monitoring results submitted in support of the application for a certificate of authorisation, the age of the closed landfill and the fact that the nearby dwellings are serviced by a public water supply, 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, or equivalent, to achieve a hydraulic conductivity of less than or equal to  $1 \times 10^{-9} \text{m/s}$ . The cap shall be installed over all areas where waste is deposited excluding the hardstanding areas;
- (c) Install gas management system in all areas where waste is deposited, within six months of the date of grant of this Certificate of Authorisation.

The gas management system shall include the following elements:

- (i) Gas vent pipes with fans or cowls, as appropriate;
  - (ii) The gas vent pipes shall not be perforated above the ground level; and
  - (iii) Spacing between the gas vent pipes shall be in accordance with EPA Landfill Manuals – Landfill Site Design.
- (a) Install at least one additional groundwater monitoring borehole downgradient of the waste body;

	<p>(b) Reseed grass within the site;</p> <p>(c) Install gas vents and gas alarms in the on-site buildings; and</p> <p>(a) 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 all buildings constructed on the facility.</p> <p>The proposed remedial actions are intended to break the SPR linkages by preventing:</p> <ul style="list-style-type: none"> <li>• migration of leachate into the aquifer and groundwater, and subsequently, into surface water bodies; and</li> <li>• migration of landfill gas to the on-site and off-site buildings.</li> </ul> <p>The recommended certificate of authorisation allows for the importation and use of soil and stone to complete the works.</p>
Proposed aftercare monitoring and assessment:	<p>Monitoring as specified in Condition 3.8 of the recommended certificate of authorisation.</p> <p>Validation report to be submitted within 30 months.</p>
Adequacy of risk assessment:	<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 two European Sites within the vicinity of the facility. These are listed in the 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 River Barrow and River Nore SAC (site code: 002162) and Ballyprior Grassland SAC (site code: 002256).

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:

- Part of the closed landfill is located within the River Barrow and River Nore SAC (site code: 002162). Hence, there is a hydrological connection between the closed landfill and this European Site.

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 River Barrow and River Nore SAC (site code: 002162) and Ballyprior Grassland SAC (site code: 002256), 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 the River Barrow and River Nore SAC (site code: 002162) and will ensure that there will be no significant impact on this European Site;
- 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 the River Barrow and River Nore SAC (site code: 002162); and
- There is no hydrological connection between the closed landfill and the Ballyprior Grassland SAC (site code: 002256).

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: River Barrow and River Nore SAC (site code: 002162) and Ballyprior Grassland SAC (site code: 002256).

## **6. Recommendation**

I recommend granting the certificate of authorisation as proposed.

Signed



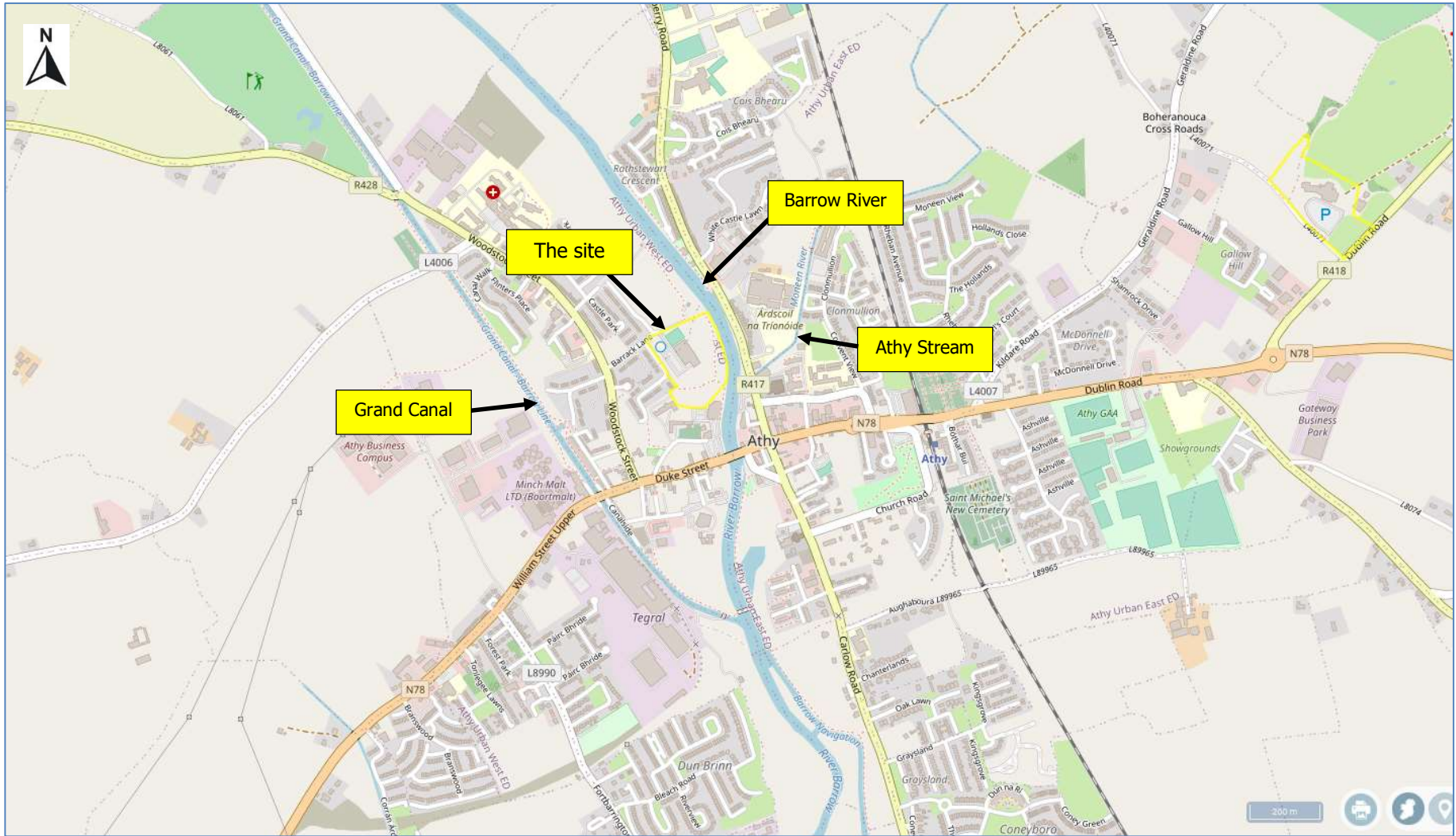
Date 4<sup>th</sup> May 2021

Ewa Babiarczyk  
Inspector

## **Procedural Note**

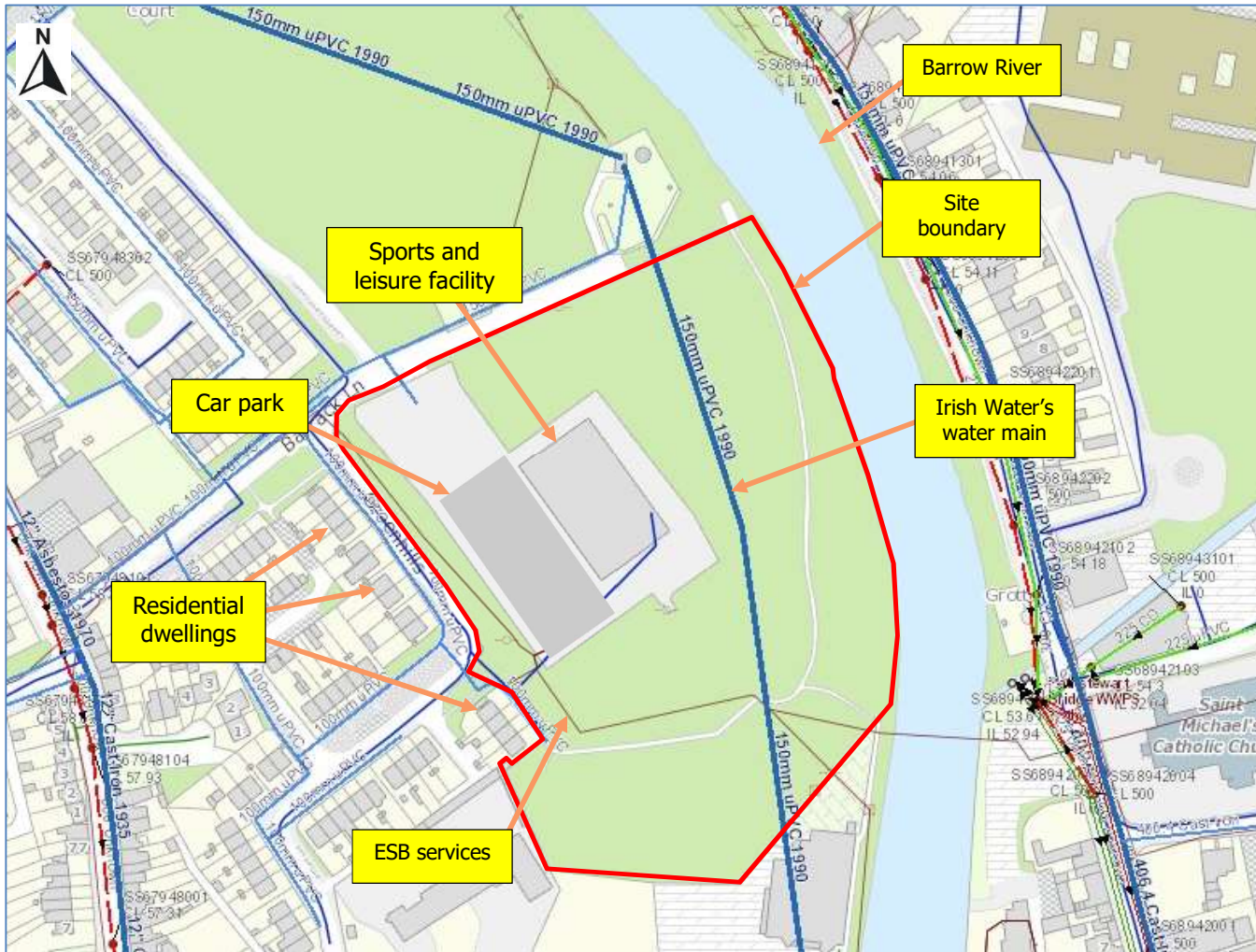
Any representations received by the Agency within 30 days of the draft certificate of authorisation being made available will be considered by the Agency.

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.

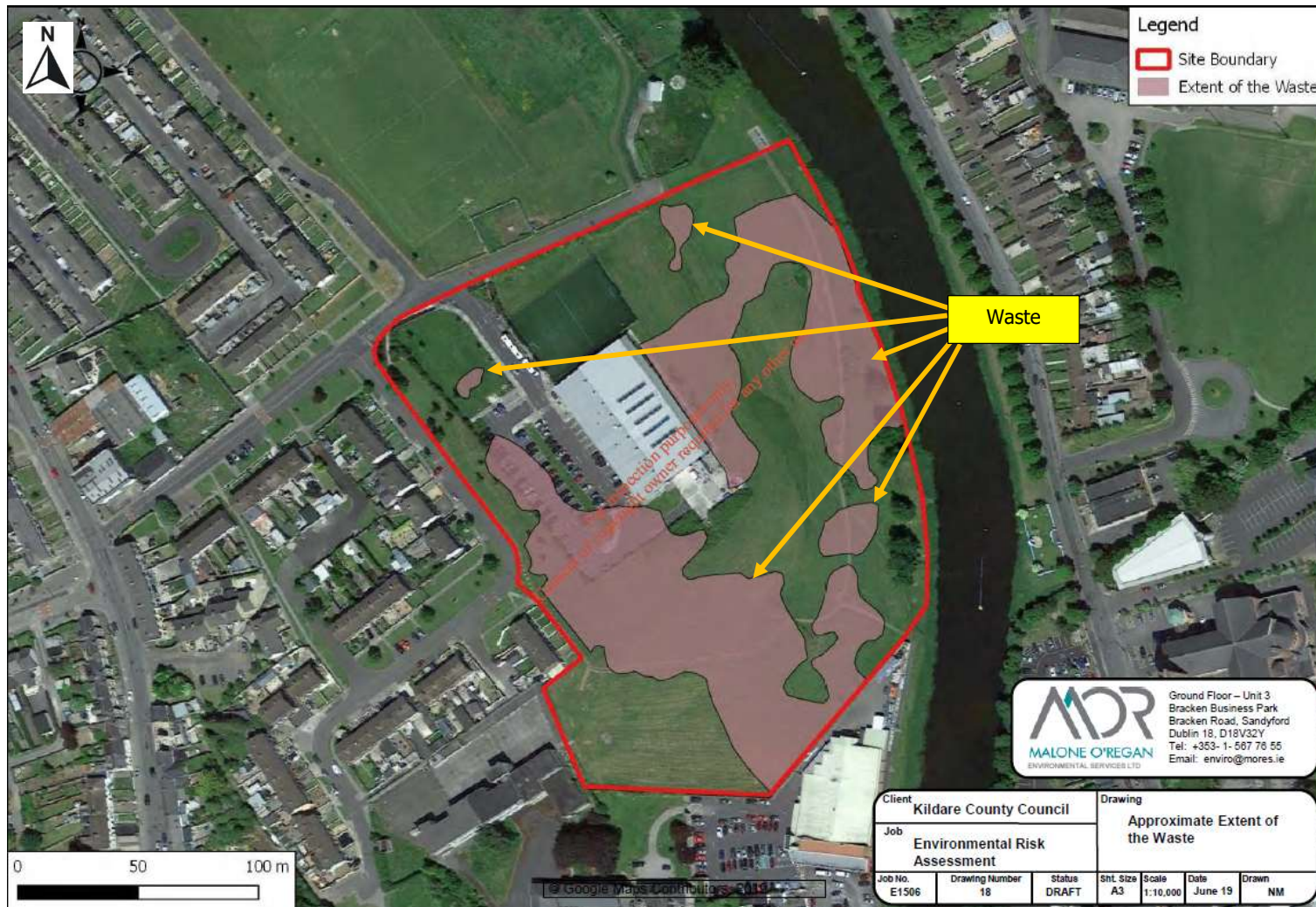


**Figure 1: Location of Greenhills (Former Refuse Depot) Landfill**





**Figure 2: Site layout and site surroundings**



**Figure 3: Approximate extent of deposited waste**

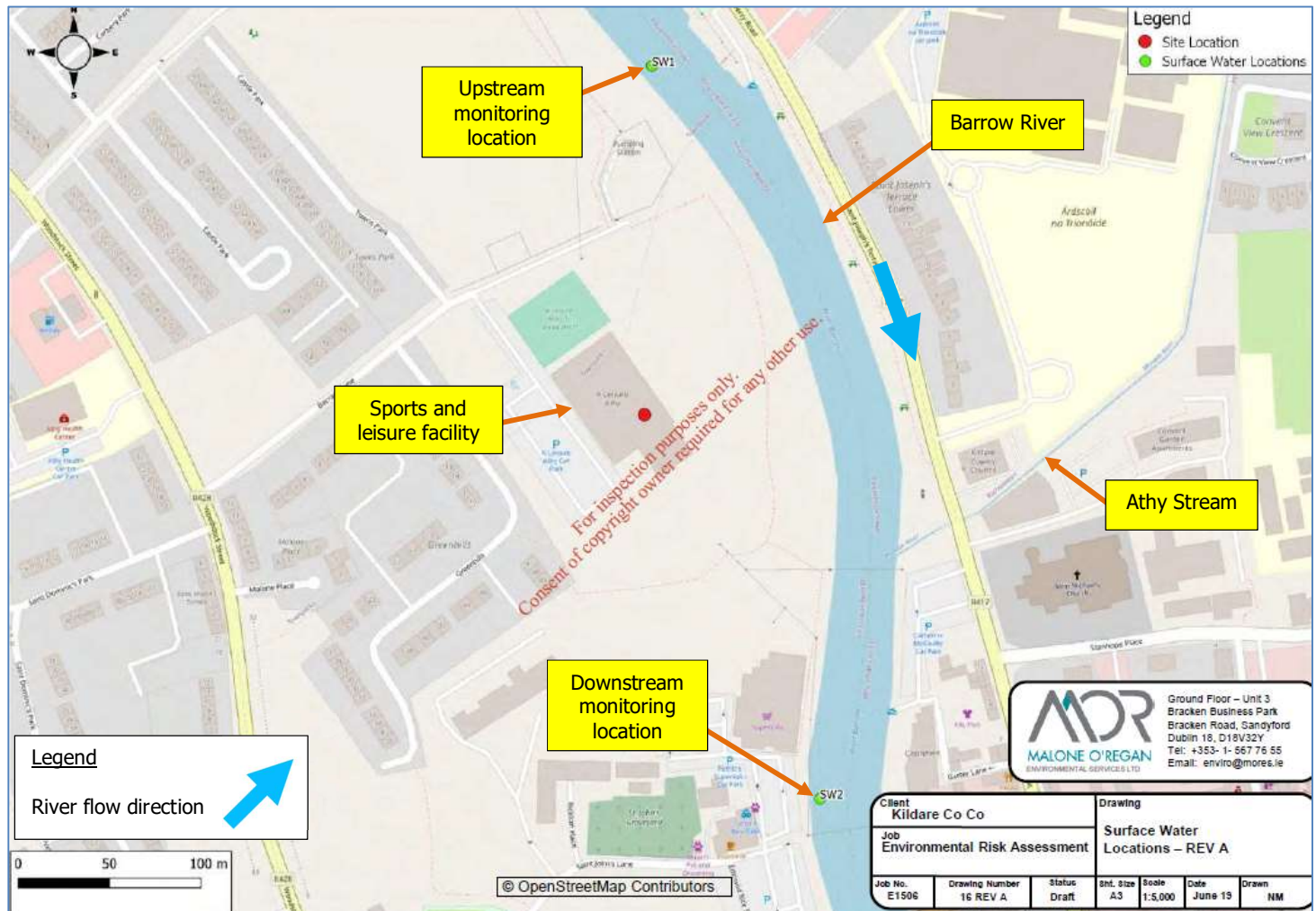


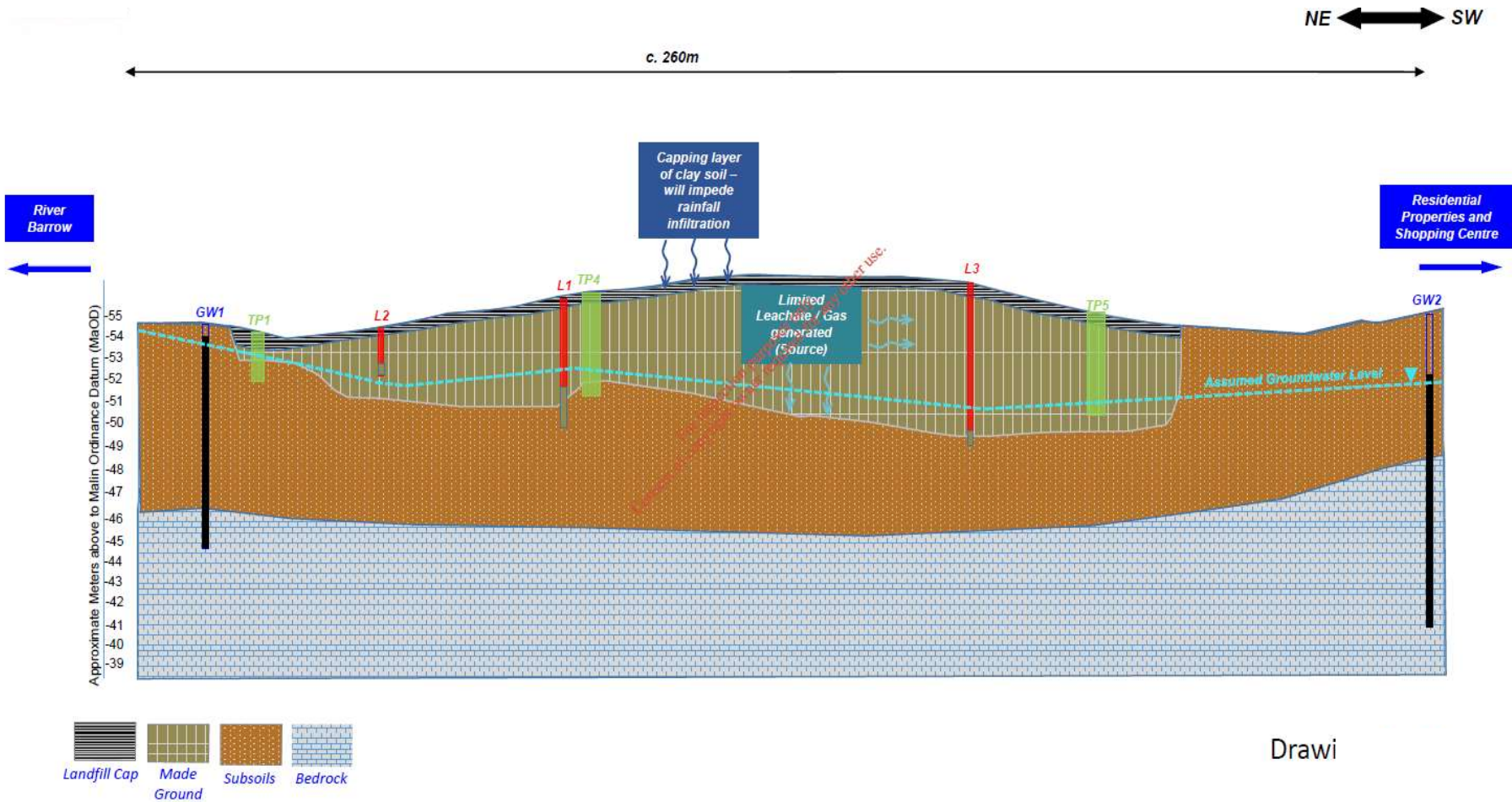
Figure 4: Surface Water Monitoring locations



**Figure 5: Groundwater flow direction**



**Figure 6: Groundwater well (GW), trial pit (TP) and leachate (L) monitoring locations**



**Figure 7: Conceptual site model for Greenhills (Former Refuse Depot) Landfill**

**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
River Barrow and River Nore SAC (site code: 002162)	Part of the closed landfill is located within this SAC	1016 Desmoulin's whorl snail <i>Vertigo moulinsiana</i> 1029 Freshwater pearl mussel <i>Margaritifera margaritifera</i> 1092 White-clawed crayfish <i>Austropotamobius pallipes</i> 1095 Sea lamprey <i>Petromyzon marinus</i> 1096 Brook lamprey <i>Lampetra planeri</i> 1099 River lamprey <i>Lampetra fluviatilis</i> 1103 Twaite shad <i>Alosa fallax</i> 1106 Atlantic salmon ( <i>Salmo salar</i> ) (only in fresh water) 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1310 <i>Salicornia</i> and other annuals colonizing mud and sand 1330 Atlantic salt meadows ( <i>Glaucopuccinellietalia maritimae</i> ) 1355 Otter <i>Lutra lutra</i> 1410 Mediterranean salt meadows ( <i>Juncetalia maritimi</i> ) 1421 Killarney fern <i>Trichomanes</i>	NPWS (2011) Conservation Objectives: River Barrow and River Nore SAC [002162]. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 19 <sup>th</sup> July 2011].	<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 3.8 requires monitoring, sampling, analysis and characterisation of leachate. It also requires sampling, analysis and characterisation of groundwater upgradient and downgradient of the waste body.</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><i>speciosum</i></p> <p>1990 Nore freshwater pearl mussel <i>Margaritifera durrovensis</i></p> <p>3260 Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation</p> <p>4030 European dry heaths</p> <p>6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels</p> <p>7220 * Petrifying springs with tufa formation (<i>Cratoneurion</i>)</p> <p>91A0 Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles</p> <p>91E0 * Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>)</p>		
Ballyprior Grassland SAC (site code: 002256)	9.4km west of the closed landfill	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates ( <i>Festuco Brometalia</i> ) (* important orchid sites)*	NPWS (2020) Conservation objectives for Ballyprior Grassland SAC [002256]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht [dated 7 <sup>th</sup> April 2020].	This SAC does not receive water from the waterbodies located at the closed landfill.