This Report has been cleared for submission to the Director by Marie O'Connor, Programme Manager

SIGNED: DATED: 3 September 2019

OFFICE OF ENVIRONMENTAL SUSTAINABILITY

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

TO:	Dr Eimear Cotter, Director
FROM:	Ewa Babiarczyk, Inspector, Environmental Licensing Programme
DATE:	3 September 2019
RE:	Application by **Limerick City & County Council** for a Certificate of Authorisation for a closed landfill at **Knocknacarriga, Cappamore, County Limerick**. Certificate of Authorisation Register Number **H0277-01**.

1. Application details

Type of facility:	Closed landfill as defined in the Regulations[1].
Original site ownership	Mr. John McCarthy, Bilboa, Cappamore, Co. Limerick (a private ownership).
Current site ownership	As above.
Operator of closed landfill	Limerick City & County Council.
Proposed use post remedial works	The site will be used for grazing of cattle.
Risk category of closed landfill:	Low risk (Class C) Using the methodology contained in the Code of Practice the overall classification of the site is Low due to the fact that all of the individual S-P-R linkages are less than 40%. Although this site is not considered to pose a significant risk to environment or to human health, a hazard may still be present. • Pollutant linkages:

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

	- Potential for landfill leachate migration to surface water and surface water dependent ecosystems, aquifer and groundwater terrestrial ecosystem and human receptors such as buildings and wells. - Potential for gas migration to human receptors (there are four houses, a farmyard and a commercial building within 250m of the site).
Section 22 register number:	S22-02471
Grid Reference	178925 E and 151209 N
Application received:	12th March 2019
AA screening determination:	1st May 2019
Regulation 7(4) notice:	1st May 2019
Additional information received:	Regulation 7(4) Reply was received on 27th May 2019. Unsolicited information was received on 29th May 2019.
Name of Qualified Person:	Finbarr Murphy, Credentials provided by Engineers Ireland.
EPA site inspection:	No inspection was required.

2. Information on the closed landfill

Location of facility	The closed landfill is located within a disused limestone quarry on the northern side slope of Knocknacarriga Hill, Cappamore, County Limerick. The quarry was approximately 50m x 30m metres in extent. The landfill site stretches between 68mAOD and 82mAOD. The location of the landfill site is shown on Figure 1.
Period of landfilling	1986 to 1988
Surrounding area	The landfill site is surrounded by agricultural lands. There is a drainage ditch downgradient from the landfill site which flows along the northern perimeter of the landfill site. This ditch is connected with the quarry floor by a pipe. Tier 2 Report states that discharge from this pipe is likely to represent the landfill leachate generated from the deposited waste. There are four houses, a farmyard with agricultural buildings and a commercial building within 250m of the closed landfill. The houses and a commercial building are located to the North-west of the site, along the R505 Cappamore – Doon road. The farmyard is located on the higher ground to the South-west of the site.

	Lower River Shannon SAC (Site Code: 002165) is located 600m North of the landfill site.
Area of the closed landfill	The landfill covers an area of 0.24 ha.
Quantity of waste at the facility	Approximately 12,000 tonnes.
Characterisation of waste deposited	The Tier 2 Site Investigation Report (Report dated May 2013 and amended in January 2019) shows that the waste body comprises of municipal waste.

3. Site investigations

Current condition and appearance of closed landfill:	The quarry and the landfill site are no longer discernible by a visual inspection. Shortly after the quarry had reached its capacity through landfilling, the landfill was capped with subsoil and topsoil. There is no landfill gas collection system or leachate collection system at the landfill site. No landfill gas, odours, vegetation die-offs or ponding of landfill leachate were observed during walk-over surveys carried out by the applicant in 2007 and 2013. A small number of plastic objects was observed however on the surface of the landfill site.
Site investigations	The extend of the closed landfill is shown on Figure 2. Tier 2 site investigation was conducted in May 2013 and showed that the lateral extent of the waste material is 2,440m^2 and estimated the volume of the waste body to be at 18,160m^3. The applicant divided the deposited waste into three different depths as shown on Figure 3. The deep waste was deposited in the main area of the quarry. The maximum depth of this waste is 13m. The medium-depth waste (referred to by the applicant as peripheral waste) is located to the North-east and South-west of the deep waste and its depth varies from 3m to 5m. The shallow waste is located to the South-east of the deep and medium-depth waste and reaches 3m in depth. The waste is in direct contact with the underlying bedrock. The investigation showed also that the waste is municipal in nature and contains a very high fraction of plastic with small amounts of textiles, glass, newspapers, timber and metal. No asbestos waste, industrial waste or large objects were detected. The investigation further found that the waste body is highly decomposed and is unlikely to be generating significant volumes of landfill gas. Any metal found was highly corroded. The investigation further showed that the waste was very homogenous in nature. There were no layers of inert capping material throughout the exposed waste body detected and the ratio of waste to inert backfill material was very high. The investigation further showed that the existing capping

	layer is allowing a small quantity of waste, predominately plastic packaging, to emerge onto the surface. An additional site inspection was carried out on 22nd May 2019. Its findings relate to a hydrological connection between the closed landfill and surface water bodies. See Section: *Hydrology* of this report for details.
Monitoring and analysis of samples (water, gas, waste):	Tier 2 site investigation included: • 3 trial holes; • 9 slit trenches; • waste sampling; • leachate sampling; • gas survey of nearby houses; and, • well survey of the nearby houses.
Hydrology	There is a small surface water drainage ditch, as shown on Figure 2, that runs along the north-eastern perimeter of the site. The flow in the drainage ditch is intermittent and any water from this drainage ditch discharges, via land drains and the Ballycoshown River (waterbody code: IE_SH_25B030500), into the Baliboa River (waterbody code: IE_SH_25B030500) which flows 1.7km downstream of the closed landfill and forms a part of Lower River Shannon SAC (Site Code: 002165). The local landowner indicated that during the operation of the site in the 1980's, Limerick County Council laid a small drainage pipe from the quarry floor to this surface water drainage ditch (see Figure 2). In May 2013, the pipe was discharging into the ditch at a rate of less than 0.008 l/s. A discharge from the drainage pipe into a dry drainage ditch was observed by the applicant on 21st November 2018. The flow rate of this discharge was recorded at 0.004 l/s. A small amount of water (no exact measurement of the flow provided) was observed in this ditch during the site investigation on 22nd May 2019.
Hydrogeology	The site overlies a poorly productive bedrock groundwater body. The bedrock beneath the landfill site consist of limestone Ballysteen formation. No karst features were detected during the geophysical survey of the site. The groundwater body is Slieve Phelim (Code: IE_SH_G_213). Its status is good and this groundwater body is not at risk. The groundwater body beneath the site is designated a locally important gravel aquifer (Lg). The aquifer vulnerability is classified as Extreme. The hydrogeological gradient follows the general topography.
Leachate and water quality:	There is a risk of landfill leachate contaminating the underlying aquifer and water in the nearby wells. The disposal of waste ceased in 1988 and it is expected that by now most of the contamination from the waste would be washed out by groundwater.

	The geophysical survey carried out as part of the risk assessment indicates a small amount of leachate outside the waste body, as shown in Figure 3. The Geophysical Survey Report states that this is likely to be caused by a small amount of groundwater flowing along a hydrogeological gradient. The site investigation further showed that the upper 4m of the waste body was dry with no seepages or perched leachate. Sampling of discharge from the said pipe was carried out in 2013 and November 2018. The results show that the discharge contains low levels of contamination and is consistent with leachate produced from a highly decomposed waste body. The result recorded for Nitrates in 2018 sample (135.7 mg/l) is much higher than the 2013 sample results (28 mg/l). The Tier 2 Report states that this would be expected in methanogenic leachate and may be originating from fertiliser spreading on these lands. An additional sample was taken from the pipe on the 5th February 2019. Ammonia as N was recorded at 18.3 mg/l and Nitrate (NO_3) was recorded at 6.817 mg/l. Tier 2 Report states that these varying results for Nitrate indicate this Nitrate is originating not from the deposited waste but rather from spreading of artificial fertiliser. Condition 3.5 requires monitoring of the discharge from the pipe and the receiving surface water drain at locations upstream and 500m downstream of the discharge from the pipe.
Landfill gas:	There is a risk of landfill gas migration to nearby houses. The most likely pathway for the migration of the landfill gas is through the underlying bedrock. There are four houses, a farmyard and a commercial building located within 250 metres of the landfill site. No landfill gas or odours were detected during the site walkover survey and no facilities were provided to contain landfill gas. The trial holes and the spoil heap were monitored for landfill gas. No landfill gas was detected during the excavation of the trial holes although slight transient odours were detected when the waste body was disturbed. Condition 3.1 requires installation of three gas monitoring boreholes within the waste body and Condition 3.5 requires monitoring to detect the presence and concentration of landfill gas on a quarterly basis.
Conceptual site model:	The conceptual site model developed in 2013 identified the following pollutant linkages: • human health exposure and emission into buildings due to off-site migration of landfill gas;

	• migration of leachate into the underlying aquifer and discharge into private wells. The SPR linkages of primary concern relate to the potential risk of lateral migration of landfill gas to human presence: • human health exposure pathway of off-site migration of landfill gas and emission into nearby houses (SPR 10); • Migration of leachate to private wells (SPR 3); • Migration of leachate to the underlying aquifer (SPR 5). The conceptual site model is shown in Figure 4. The source, pathways and receptors can be described as follows: Source: – Rainfall on the landfill will preferentially percolate through the cap and into the waste. – Leachate is generated in the waste. – Gas is generated at the landfill. Pathway: – Leachate migration from the site through the bedrock into the locally important aquifer. – Leachate can migrate through the base of the landfill into underlying aquifer beneath and discharge to the adjoining surface water body (drain) and private wells. – Gas migration can occur through the permeable cap and through fractured bedrock beneath the waste. – Gas migration beyond the site boundary. Receptors: – the underlying bedrock and locally important aquifer; – houses and private wells outside the site; – The Lower River Shannon SAC located 600 m to the north of the site; – Surface water bodies between 250m and 1km of the site. No public groundwater supply sources are present within 1km of the site.

4. SPR linkages and remedial actions

SPR linkage scenarios (applicable ones only):	<u>Landfill gas migration</u> SPR 10: Lateral migration of landfill gas to nearby houses. Receptor = Human <u>Leachate migration</u> SPR 3: Migration of leachate to private wells. Receptor = Human

	SPR 5: Leachate migration to groundwater. Receptor = The underlying aquifer Summary: Upon the review of the monitoring data and risk assessment: - Remedial action is warranted to address the risk of offsite migration of landfill gas. - Remedial action is warranted to address the risk of leachate migrating from the site to the receiving groundwater body.
Proposed remedial actions:	The following remedial actions to improve the capping layer by utilising an inert landfill capping system are recommended in Condition 3.1: - Reprofile the existing topsoil. - Install a low permeability landfill cap, minimum 1m, with 1mm thick low permeability geomembrane having a hydraulic conductivity of less than or equal to $1x10^{-9}$m/s. Additionally, Condition 3.1 requires the installation of three gas monitoring boreholes within the waste body. Condition 3.5 requires monitoring to detect the presence and concentration of landfill gas on a quarterly basis and for a period of at least two years. The proposed remedial actions are intended to break the SPR linkages by preventing: - potential migration of leachate to groundwater; and - migration of landfill gas to off-site locations. The proposed capping will also prevent any waste materials from appearing on the surface of the landfill site. The draft Certificate of Authorisation allows for the importation and use of soil and stone to complete the works. Condition 3.15 of the recommended certificate of authorisation provides for a communications programme directed at the occupiers of buildings adjacent to deposited waste (the site). The communications programme will inform the relevant occupiers of what they should be doing to protect their property, health and well-being, and members of the public from the risk of an incident involving landfill gas.
Proposed aftercare monitoring and assessment:	Monitoring as specified in Condition 3.5 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 is adequate for the following reasons: • It has identified, assessed and adequately addressed the associated risks inherent with the landfill site. • An Appropriate Assessment screening was also completed to evaluate the potential risk to the European sites associated with the nearby receiving waters • Report of Tier 2 intrusive investigation shows that municipal waste was deposited in the landfill.

5. Appropriate assessment

There are three 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 Lower River Shannon SAC (Site Code: 002165), Slievefelim to Silvermines Mountains SPA (Site Code: 004165) and River Suir SAC (Site Code: 002137).

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:

- The landfill site is situated 600m south of the Lower River Shannon SAC (Site Code: 002165); it cannot be certain that there is no groundwater connectivity between the landfill site and this SAC.

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 Lower River Shannon SAC (Site Code: 002165), Slievefelim to Silvermines Mountains SPA (Site Code: 004165) and River Suir SAC (Site Code: 002137), 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 avoid the potential for water pollution and will ensure that there will be no significant impact on Lower River Shannon SAC (Site Code: 002165), and with a further objective to result in positive impacts to current water quality conditions.

- the project, alone or in-combination with other projects, will not adversely affect the integrity, and conservation status of any of the qualifying interests of Lower River Shannon SAC (Site Code: 002165).
- Condition 3.5 requires ongoing environmental assessment and monitoring.
- Slievefelim to Silvermines Mountains SPA (Site Code: 004165) is located upstream of the landfill therefore, there will be no impact caused by the hydrological connection between the landfill and this SPA. Also, there are no significant emissions to air from the landfill which could affect bird species Slievefelim to Silvermines Mountains SPA (Site Code: 004165) is designated for.
- There is no hydrological or hydrogeological connection between the landfill and River Suir SAC (Site Code: 002137).

In light of the foregoing reasons, no reasonable scientific doubt remains as to the absence of adverse effects on the integrity of these European Sites: Lower River Shannon SAC (Site Code: 002165), Slievefelim to Silvermines Mountains SPA (Site Code: 004165) and River Suir SAC (Site Code: 002137).

6. Consultation

I consulted Mr. John Gibbons (OEE) in relation to the landfill gas assessment and the landfill leachate assessment and associated remediation measures.

7. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed

Date 3rd September 2019

Ewa Babiarczyk

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 the Knocknacarriga Landfill Site

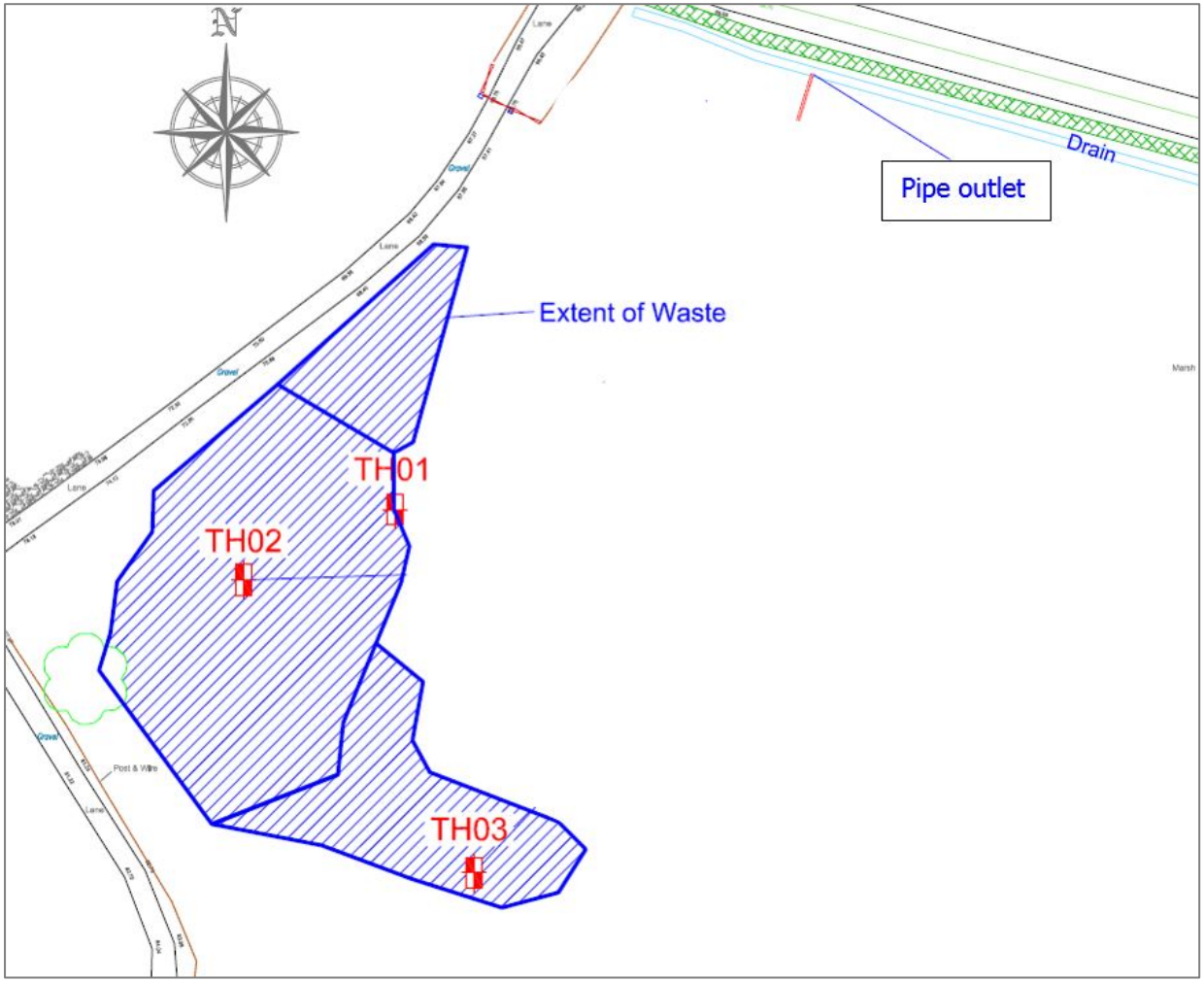

Figure 2: Extent of the Landfill Site

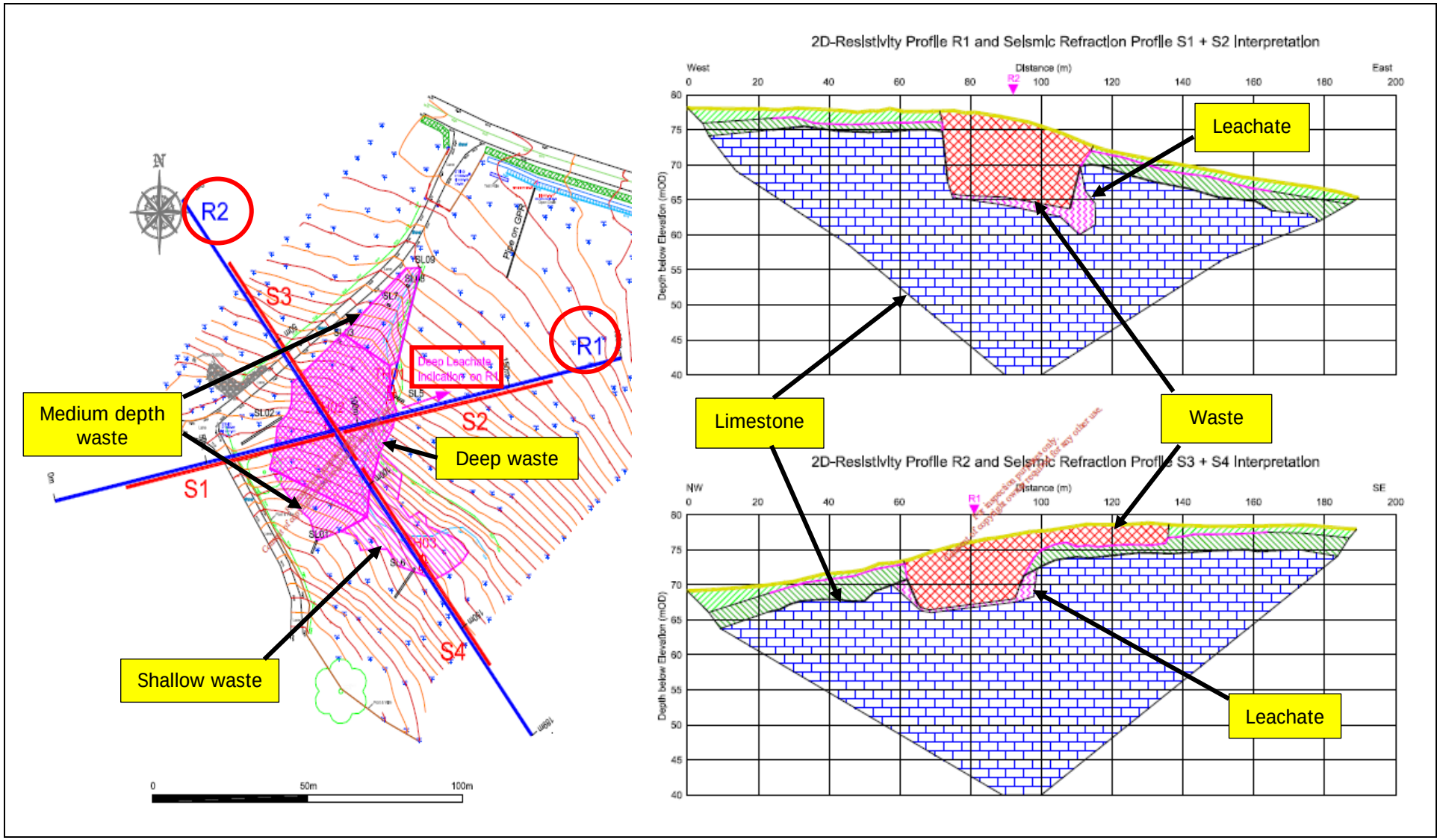

Figure 3: Interpretation of the Geophysical Survey

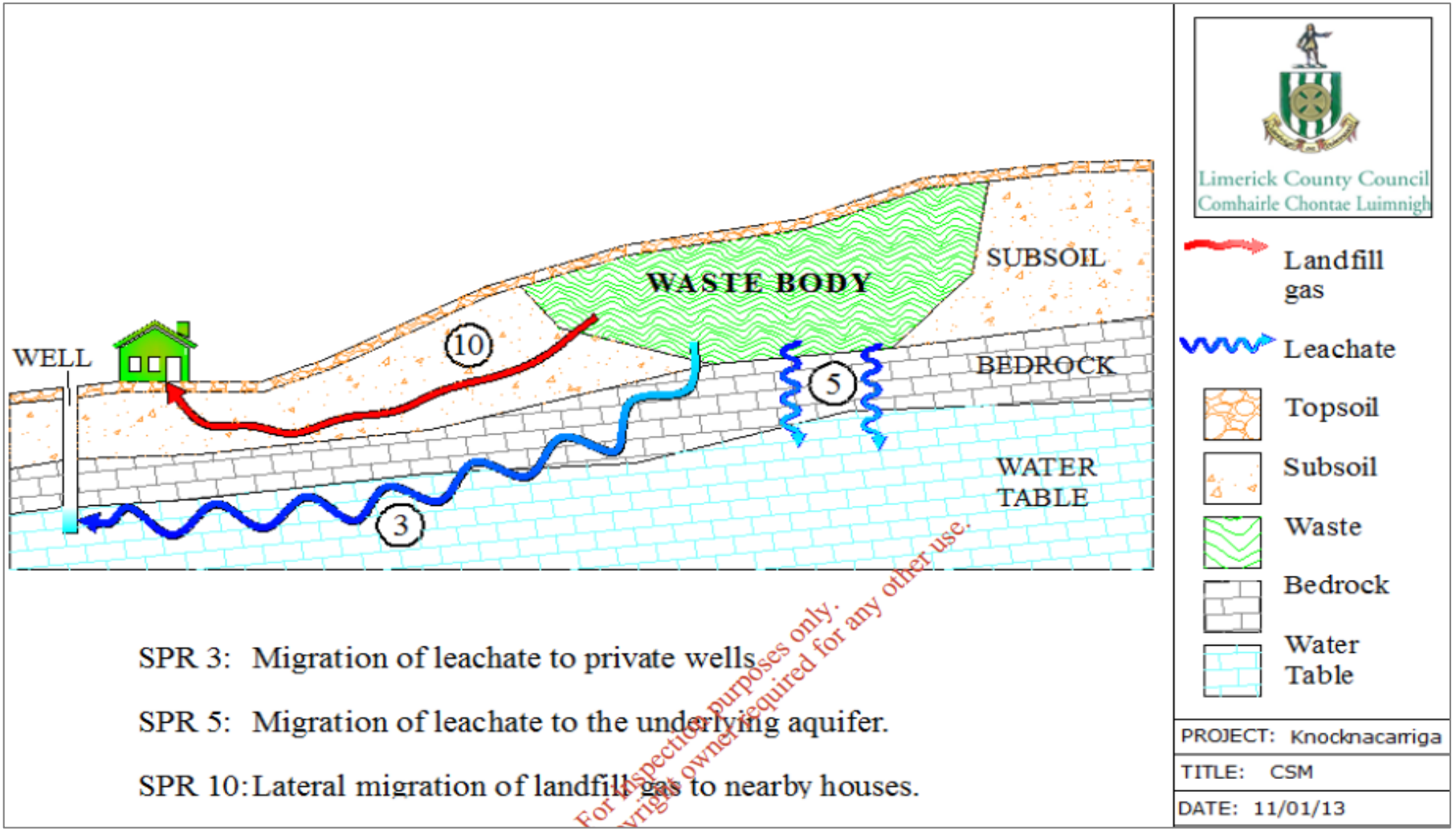

Figure 4: Conceptual site model for the landfill site

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

Site Name	Distance To (m)	Qualifying Interests (* denotes a priority habitat)	Conservation Objectives	Assessment
Lower River Shannon SAC (Site Code: 002165)	600m north of the facility	**Habitats** 1110 Sandbanks which are slightly covered by sea water all the time 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1150 *Coastal lagoons 1160 Large shallow inlets and bays 1170 Reefs 1220 Perennial vegetation of stony banks 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts 1310 *Salicornia* and other annuals colonizing mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	NPWS (2012) Conservation Objectives: Lower River Shannon SAC 002165. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 07 August 2012].	<u>Emission to Water</u> There are no emissions from the landfill site to surface water. <u>Conclusion:</u> Condition 3 of the certificate of authorisation outlines the remedial actions required at the site. Condition 3.5 requires monitoring, sampling, analysis and characterisation of leachate. It also requires biannual sampling of the surface water drain located downgradient from the landfill site and sampling, analysis and characterisation of groundwater from on-site and off-site boreholes. The controls in the recommended certificate of authorisation ensure the qualifying interests of the European sites are protected. <u>Emissions to Air</u> Recommended certificate of authorisation requires installation of a landfill cap and three gas monitoring boreholes within the waste body. <u>Conclusion:</u>

		6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) **Species** 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* 1095 Sea Lamprey *Petromyzon marinus* 1096 Brook Lamprey *Lampetra planeri* 1099 River Lamprey *Lampetra fluviatilis* 1106 Atlantic Salmon *Salmo salar* (only in fresh water) 1349 Bottlenose Dolphin *Tursiops truncatus* 1355 Otter *Lutra lutra*		The controls in the recommended certificate of authorisation ensure the qualifying interests of the European sites are protected.
Slievefelim to Silvermines Mountains SPA (Site Code: 004165)	3.5 km north of the facility	**Birds** A082 Hen Harrier *(Circus cyaneus)*	NPWS (2018) Conservation objectives for Slievefelim to Silvermines Mountains SPA [004165]. Generic Version 6.0. Department of Culture, Heritage and	Slievefelim to Silvermines Mountains SPA (Site Code: 004165) is located upstream of the landfill therefore, there will be no impact caused by the hydrological connection between the landfill and this SPA. Also, there are no significant emissions to air from the landfill which could affect the bird species this SPA is designated for.

			the Gaeltacht [dated 21/02/2018].	
River Suir SAC (Site Code: 002137)	12.7 km east of the closed landfill site.	**Habitats** 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) 1410 Mediterranean salt meadows (Juncetalia maritimi) 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels 91A0 Old sessile oak woods with *Ilex* and *Blenchnum* in the British Isles 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* 91J0 *Taxus baccata* woods of the British Isles* **Species** 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* 1092 White-clawed Crayfish *Austropotamobius pallipes* 1095 Sea Lamprey *Petromyzon marinus*	NPWS (2017) Conservation Objectives: Lower River Suir SAC 002137. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs [dated 28th March 2017]	There is no hydrological or hydrogeological connection between the landfill and this SAC.

		1096 Brook Lamprey *Lampetra planeri* 1099 River Lamprey *Lampetra fluviatilis* 1103 Twaite Shad *Alosa fallax fallax* 1106 Salmon *Salmo salar* 1355 Otter *Lutra lutra*		