


This Report has been cleared for submission to the Board by David Flynn,
Programme Manager

Signed: 

Dated: 21 March 2019



OFFICE OF ENVIRONMENTAL SUSTAINABILITY

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

TO:	Eimear Cotter, Director	
FROM:	Magnus Amajirionwu, Inspector	Environmental Licensing Programme
DATE:	28 March 2019	
RE:	Application by Kildare County Council for a Certificate of Authorisation for a closed landfill at Carrigeen, Clane, County Kildare . Certificate of Authorisation Register Number H0210-01 .	

1. Application details

Type of facility:	Closed landfill as defined in the Regulations ¹
Original site ownership	Kildare County Council leased the site from the owner between 1st August 1977 and 20th June 1980. The site, prior to the lease, was a disused gravel and rock quarry pit. The site was closed in 1980.
Current site ownership	In private ownership
Operator of closed landfill	Kildare County Council
Proposed use post remedial works	The site will continue to be used as agricultural land mainly for grazing.
Risk category of closed landfill:	Moderate risk (class B) <ul style="list-style-type: none">Reason(s): pollutant linkages:<ul style="list-style-type: none">Leachate migration to surface water and groundwater,Off-site human receptors from landfill gas migration.
Section 22 register number:	S22-02430

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

Application received:	07/03/2014
AA screening determination:	12/12/2018
Regulation 7(4) notice:	10/02/2017
Additional information received:	26/10/2018
Name of Qualified Person:	Mr Sean Moran MSc, P.Geol. Certified by the Institute of Geologists of Ireland (IGI) as qualified person in accordance with Section 2.3 of Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA, 2007).
EPA site inspection:	5 October 2018

2. Information on the closed landfill

Location of facility	<p>Carrigeen Landfill is located within a residential area, approximately 1km south of Clane village (Figure 1). It is located at the end of a cul-de-sac which provides access to one-off houses and paddocks.</p> <p>The site is currently divided into three sections, used namely: as a garden to the west, paddock centrally, and disused / scrub to the east. This eastern area of the site has been used in the past as an area for quad bike scrambling.</p> <p>For the purposes of the risk assessment, continued agricultural use has been envisaged by the Qualified Person.</p>
Period of landfilling:	1977 – 1980
Surrounding area:	<p>The surrounding land use is residential and amenity. A single dwelling is located 7.5m to the west of the waste body. A second dwelling is located 40m southeast of the waste body. The River Liffey is 85m to the east of the waste body and flows parallel to the eastern boundary in a northerly direction. A stream located 6.5m north of the site joins the River Liffey at about 85m to the north-east of the site. Millicent Golf Course is immediately south of the waste body.</p> <p>In total, there are approximately 17 residences within 250m radius of the site.</p>
Area of the closed landfill	0.979 hectare shown in Figure 2.
Quantity of waste at the facility	Approximately 31,500 m ³ or 15,750 tonnes estimated (applying the conversion ratio for municipal waste of 0.4).
Characterisation of waste deposited	Waste characterisation indicated domestic, commercial and construction and demolition waste. The municipal waste comprised of general plastic, rags, bottles, textiles, paper and wood. A strong waste odour was observed while excavating in the waste layers at some locations. The construction and demolition (C&D) waste comprised of crushed stone, brick and reworked soils.

	The capping material used at the site varied from a gravelly silty sand layer in the waste ground to a brown silty sand containing clay over the remainder of the site.
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3. Site investigations

Current condition and appearance of closed landfill	<p>There is a steep gradient falling from south to north of the site, with depressions evident in the east of the site where (waste deposit) settlement has occurred. The site's topography varies across the closed landfill from 73.75m AOD in the south-western corner, to its highest point of approximately 75m AOD at the centre, and to its lowest point on the north-eastern corner of the site at 67.5m.</p> <p>According to the updated Risk Assessment Report (2018) submitted by the applicant, waste was deposited to a depth of 1.0m to 5m across the waste body footprint, including the capping layer that ranges in thickness from 0.3 to 1.6m. The maximum depth of waste was reported to be approximately 5m below ground level (bgl) in the centre of the site.</p> <p>The existing site layout and its surroundings is shown in Figure 3, including:</p> <ul style="list-style-type: none"> • private residence and gardens to the west of the site; • large field to the east of the residence referred to in the Risk Assessment Report (2018) as the 'waste ground' (also referred to as the 'Western Paddock'); • 'Eastern Paddock' to the northeast of the 'Western Paddock'; and • 'Southern Paddock' in the south-eastern corner of the site. <p>All above-mentioned fields are currently separated from each other by fencing.</p> <p>Tier 2 Site Investigation Report (2010) stated that during the winter months ponding of what appears to be leachate occurs along the northern boundary. This overflows onto the road and enters a stream on the north side of the road. The stream was however dry on the day of the site visit.</p> <p>The site has an existing access/egress point on the north-eastern corner of the eastern paddock. An internal access road follows the eastern boundary of the eastern paddock as far as the southern 'paddock'.</p> <p>The undeveloped part of the landfill is generally surrounded by walls or fencing to limit access. The western boundary has landscaping trees.</p>
Site investigations	<p>Geophysical survey (2010): Indicated that the area of waste material is concentrated in the field to the west of the residential property (Figure 3) but may extend to the front, side and rear gardens of the property as well as into the paddock to the rear of the property. The geophysical survey indicated a waste thickness of approximately 5m in the centre of the site. However, trial pitting, as described below, indicates that in fact there is no waste in the front, side or rear gardens of the property.</p> <p>Intrusive site investigations completed in 2010 included:</p> <ul style="list-style-type: none"> • Excavation of 13 trial pits to depth 4.5 mbgl; • Installation of 3 groundwater monitoring wells (50mm diameter) to a depth of 8 mbgl; • Installation of 2 leachate monitoring wells (50mm diameter) to a depth of 6 mbgl;

	<ul style="list-style-type: none"> Monitoring of 33 locations for landfill gas using a spike probe to a maximum depth of 4 mbgl. <p>A topographical survey of all investigation locations was carried out. Soil samples were sent out for a suite of laboratory analysis and analysis for geotechnical properties. In addition, one surface water sample from the stream to the east of the site; two leachate samples and three groundwater samples were dispatched for analysis.</p> <p>Trial pitting showed that the waste is contained within the site boundaries. The quarry area is 0.98Ha with the waste footprint covering a smaller area within the quarry (c 0.70ha, see Figure 3).</p> <p>In the updated Risk Assessment Report (2018), Kildare County Council stated to have completed further monitoring of the wells in 2012, 2013, 2015 and 2017. Another monitoring programme was completed in September 2018 by the Council's appointed consultants.</p>
Monitoring and analysis of samples (water, gas, soil)	<p>Monitoring carried out between 2010 and 2018 were as follows:</p> <ul style="list-style-type: none"> 2 rounds of gas monitoring were conducted at 33 locations. Leachate samples were taken at 2 locations. Surface water was sampled in 3 locations downstream to the north of the site, upstream and downstream of River Liffey. Groundwater was sampled in 3 locations. Soil was sampled in 12 locations. <p>An ecological survey and assessment as part of the Tier 3 risk assessment, in accordance with EPA Code of Practice, was also conducted.</p>
Hydrology	<p>The site lies within the Liffey Lower 03 Water Body (IE_EA_09L011500). The River Liffey is located approximately 85m to the east of the site and flows in a north to south direction. A weir is located approximately 150m to the northeast of the site which serves to impede the flow of the river. The Liffey is part of Hydrometric Area 09 of the Eastern River Basin District.</p> <p>The water body has been assigned Good Status and is not at risk. The EPA has conducted biological quality monitoring at Alexandra Bridge in Clane approximately 300m downstream of the site over a number of years. The biological quality value (Q Rating) is 4 or 'Good' overall status.</p>
Hydrogeology	<p>The natural ground comprises limestone derived sands and gravels. The site is underlain by massive, unbedded lime mudstones from the Waulsortian Formation. The bedrock underlying the site is a Locally Important Aquifer (LI) which is moderately productive only in local zones. The groundwater vulnerability is classified as 'Extreme' which reflects the historical site use as a quarry.</p> <p>The GSI wells database indicates that there are no wells in the aquifer within 1km of the site. Four wells identified in the Dinantian Pure Bedded Limestone (DPBL), also called the Rickardstown Formation (RF), are located to the south and east of the site. This is classed as a Locally Important Karstic aquifer. The wells are reported to be dug wells with poor yields. The site lies within the Dublin Groundwater Body (GWB) IE_EA_G_008. The GWB status is rated as 'Good'.</p> <p>Groundwater flow locally, is expected to be from south to north/northeast toward the River Liffey, based on the topography and local hydrology.</p>
Leachate and water quality	<p>Leachate results compared against published minimum and maximum observed ranges show that the key leachate parameters BOD, COD, ammonia</p>

	<p>and sodium, and metals were either below or within the published ranges. The results are indicative of a weak and aged leachate with approximately 90% of the values below the mean values for a landfill that is in Stage IV of the degradation process.</p> <p>With the absence of a landfill liner or natural confining layer present, leachate will impact on the groundwater body beneath the site. Elevated levels of chloride, ammonia, potassium, manganese, arsenic and occasionally hydrocarbons have been observed in groundwater monitoring results. Extractable petroleum hydrocarbons (EPH) was elevated in the past but was not detected in 2018 monitoring event.</p> <p>Leachate is also migrating from the site into the adjoining surface waters. However, taking account of the findings of the updated monitoring data and surface water assessment together with the ecological assessment, it is considered that there is no significant impact on the receiving water quality and aquatic habitats adjoining the site.</p> <p>Accordingly, any potential impacts on the receiving environment associated with leachate are considered not significant, and are expected to continue to decline over time. Surface water monitoring undertaken between 2013 and 2018 does not show any significant deterioration in water quality between upstream and downstream of the landfill.</p>
Landfill gas	<p>The ongoing generation of landfill gas at the landfill and the close proximity of residential dwellings means there is a potential for gas to migrate and accumulate in a manner that potentially poses a risk to property and people.</p> <p>There is risk posed by the presence of methane from the site. Recorded concentration of methane (CH₄) was observed to range between 0.0 to 39.2 % (v/v), carbon dioxide between 1.3 and 31.9 % (v/v) and Oxygen between 0.01 to 18.7% in 2010 at 33 locations. In 2018, monitoring results indicate that landfill gas is still being generated in the landfill based on the methane 2.4 to 16.5% (v/v) and carbon dioxide 3.7 to 27.8% (v/v) levels detected in the leachate wells at two locations. The spike probe survey did not detect the presence of landfill gas close to the surface of the landfill or along the boundary. However, it is possible that gas migration could be occurring below the probe penetration depth as the probe was merely advanced approximately 0.3-0.5m below ground level.</p> <p>Landfill gas generation and migration is the focus of the risk assessment and proposed remedial actions submitted by Kildare County Council. The remedial measures proposed include the installation of a gas collection trench around the waste body perimeter with a series of gas ventilation pipes. Three vertical ventilation wells are proposed be installed to the west of the gas collection trench to ventilate gas that may be present in the quarry footprint (Figure 5).</p>
Conceptual site model	<p>The conceptual site model identified the following pollutant linkages:</p> <ul style="list-style-type: none"> • human health exposure and emission into buildings due to off-site migration of landfill gas; • migration of leachate into the adjoining surface water body; and • migration of leachate into the underlying aquifer and groundwater body. <p>The Qualified Person identified the pollutant linkages that warrant remedial action as:</p> <ul style="list-style-type: none"> • leachate migration to surface water (SPR 8) • human health exposure pathway of off-site migration of landfill gas and emission into off-site building (SPR 10).

	<p>The conceptual site model is shown in Figure 4. The source, pathways and receptors can be described as follows:</p> <p>Source:</p> <ul style="list-style-type: none"> - Rainfall on the landfill will preferentially percolate through the cap and into the waste. - Leachate is generated in the waste albeit at low strength. <p>Pathway:</p> <ul style="list-style-type: none"> - Leachate can migrate into surface water body. - Gas migration can occur upwards through the permeable cap and downwards into bedrock beneath the waste. - Gas migration beyond the site boundary. <p>Receptors:</p> <ul style="list-style-type: none"> - Existing houses and users in close proximity of the site. - The bedrock aquifer beneath the site. - The surface water south of the site.
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4. SPR linkages and remedial actions

<p>SPR linkage scenarios (applicable ones only)</p>	<p>Leachate migration through surface water pathway SPR 8, Receptor = Surface water body.</p> <p>Landfill gas lateral migration to human presence SPR 10, Receptor = Human</p> <p>Summary:</p> <p>Upon the review of the updated monitoring data, surface water assessment and the ecological assessment;</p> <ul style="list-style-type: none"> - the impact of leachate migrating from the site is considered not significant on the receiving water quality. - remedial action is warranted to address the risk of offsite migration of landfill gas.
<p>Proposed remedial actions</p>	<p>The risk assessment and remedial actions are based on the current use at the closed landfill – agriculture.</p> <p>It is proposed to install a gas collection trench extending around the perimeter of the waste body footprint. The trench will have 100mm diameter vertical risers extending from the base of the trench to approximately 200mm above the top of the trench and they will be located at 20m centres along the trench. The trench will be 500mm wide and extend to approximately 3 mbgl. It is proposed to line the trench with a permeable membrane (terram or similar). The depth of the trench is based on the anticipated depth to groundwater, which based on monitoring of groundwater in the wells in September of 2018 is about 3.5 mbgl beneath the landfill area. This was however, after a prolonged dry summer period and it is anticipated that the level will rise significantly in the winter. The trench will be backfilled to the surface with granular fill not less than 25mm in diameter and of limestone origin.</p> <p>The landfill area inside the gas collection trench footprint will be capped with 850mm of subsoil which will be compacted and graded to fall to the northeast corner. It will then be covered with approximately 150mm of top soil and</p>

	<p>grass seeded. The horse paddock in the south of the site will be retained as requested by the site owner.</p> <p>A surface water collection pipe will drain the site and divert run off under the road to the surface water drain located north of the site. It is also proposed to open a trench across the road to connect the stormwater pipe from the landfill area to the drain on the north side of the road.</p> <p>Eight vertical gas ventilation wells will be installed in the cap to reduce the build-up of landfill gas beneath the clay cap. The wells will be of similar construction to the vertical risers in the gas collection trench.</p> <p>The draft Certificate of Authorisation allows for the importation and use of soil and stone to complete the works.</p> <p>Condition 3.14 of the recommended certificate of authorisation provides for a communications programme directed at the occupiers of property in close proximity to the closed landfill site. The communications programme will inform these people of what they should be doing to protect their property and health and well-being from the risk of an incident involving landfill gas.</p>
Proposed aftercare monitoring and assessment	<p>Monitoring as specified in Condition 3.5 of the recommended certificate of authorisation.</p> <p>Validation report to be submitted within 30 months as specified in Condition 3.3.</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 for the following reasons:</p> <ul style="list-style-type: none"> • 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 adjoining receiving waters • Report of Tier 2 intrusive investigation show that municipal waste deposited in the landfill was relatively low in biodegradable waste. Therefore, the waste deposits in the "closed landfill" will present relatively low risks of ongoing leachate and gas generation.

5. Appropriate assessment

A screening for Appropriate Assessment was undertaken to assess, in view of best scientific knowledge and the conservation objectives of the site, if the proposed 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 the Ballynafagh Bog [SAC 000391], Ballynafagh Lake [SAC 001387], and Rye Water Valley/Carton [SAC 001398].

That the activity is not directly connected with or necessary to the management of the site as a European Site and that it can be excluded on the basis of objective scientific information, that the activity, individually or in combination with other plans or projects, will have a significant effect on a European site, and accordingly it was determined that an Appropriate Assessment of the activity is not required.

The reason for this determination is as follows:

- Ballynafagh Bog [SAC 000391] and Ballynafagh Lake [SAC 001387] which is located approximately 5.5 km from the site, have no hydrological connection between them and the Carrigeen landfill site.

- Carrigeen landfill site is located 15 km from the Rye Water/Carton Valley [SAC 001398]. Though the landfill site is hydrologically connected to the Rye Water/Carton Valley SAC via River Liffey, it is the Rye River that flows into the River Liffey; thereby minimising or eliminating the risk of the River Liffey effecting the Rye Water Valley/Carton SAC. Results of the Detailed Quantitative Risk Assessment also indicate that no exceedances were identified (of site specific levels) for the River Liffey.

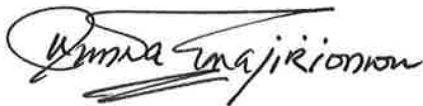
6. Consultation

I consulted with Mr John Gibbons (OEE) on landfill gas assessment and treatment.

7. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed



Magnus Amajirionwu

Date 28 March 2019

Procedural Note

Any representations received by the Agency within 30 days of the draft certificate of registration 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 landfill. (Source: Certificate of Authorisation Application from Kildare County Council)



Figure 2 Boundaries at the closed landfill. (Source: Certificate of Authorisation Application from Kildare County Council)

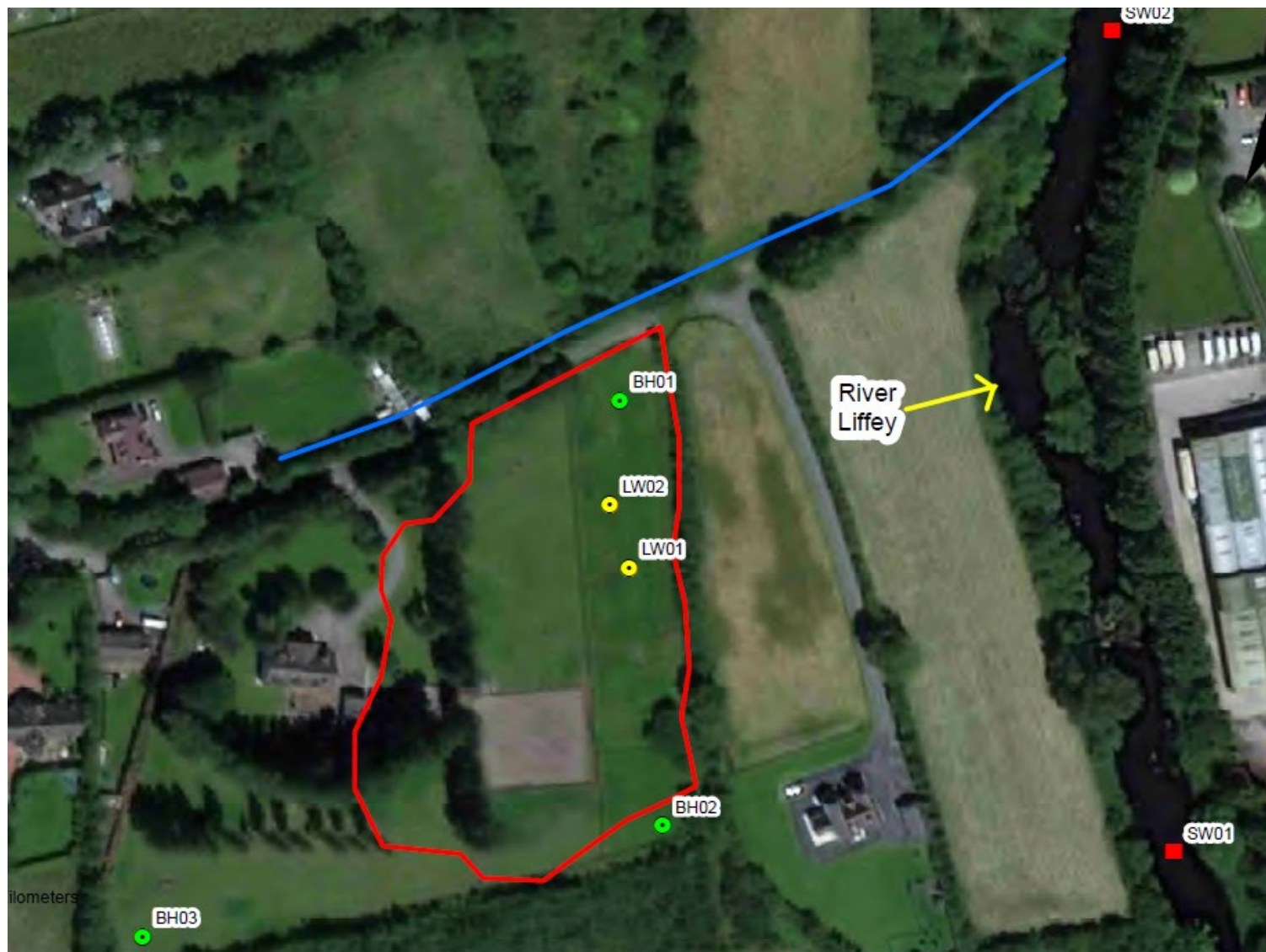


Figure 3 Current site use and surrounding properties. (Source: Certificate of Authorisation Application from Kildare County Council)

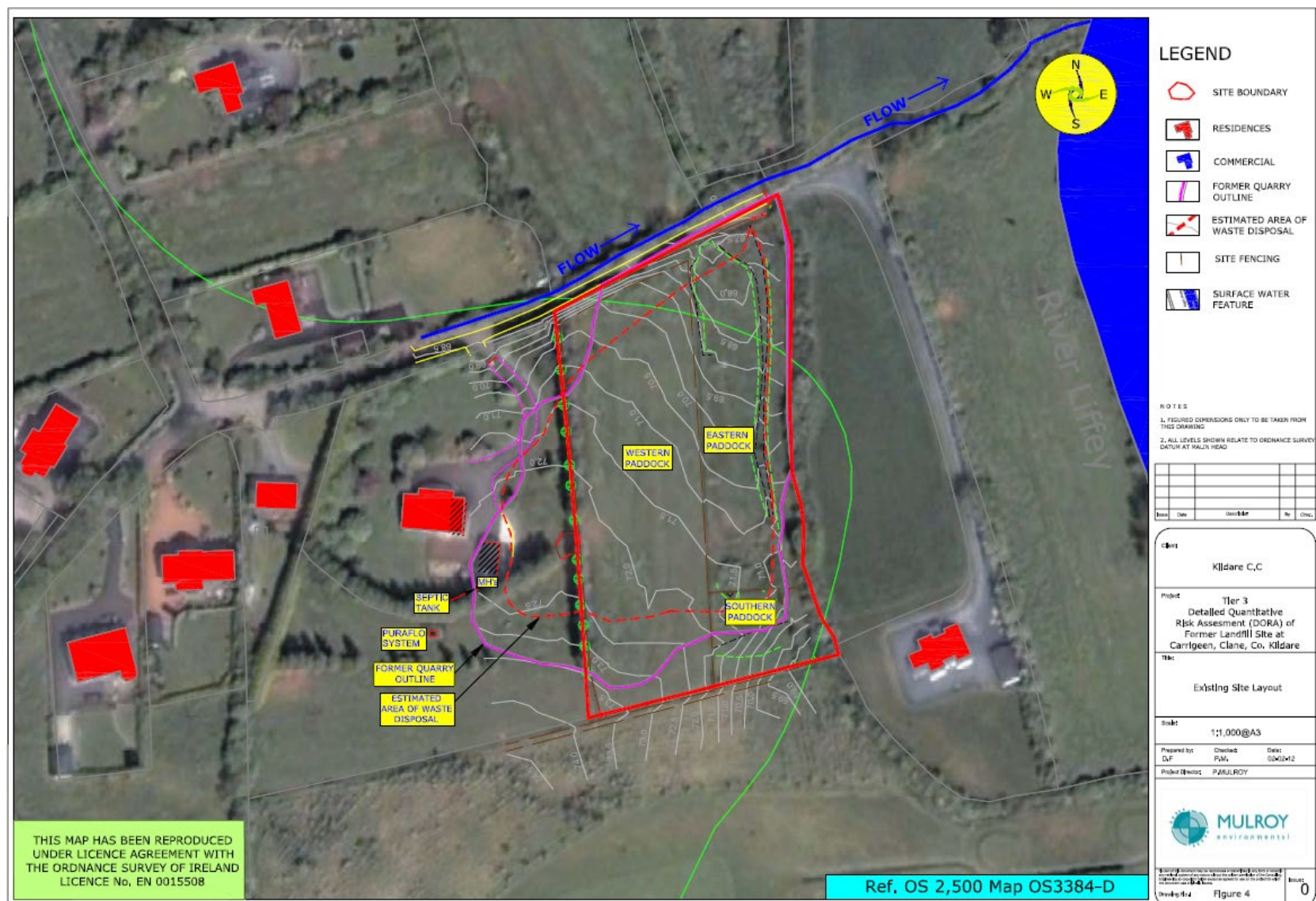


Figure 4 Conceptual site model. (Source: Certificate of Authorisation Application from Kildare County Council)

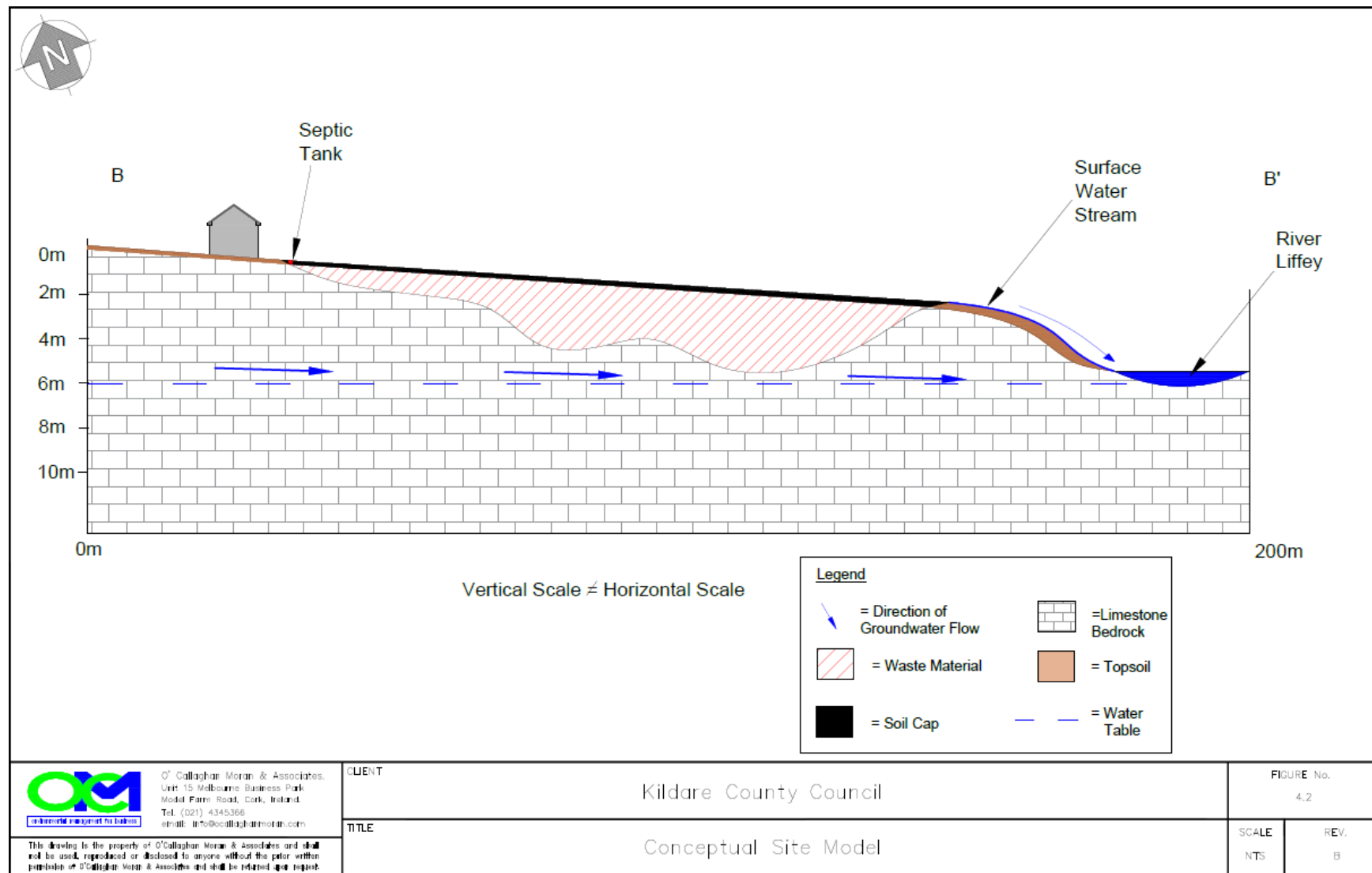


Figure 5: Outline of gas collection trench and gas ventilation pipes. (Source: Certificate of Authorisation Application from Kildare County Council)

