**This Memo has been approved for submission to the Board by David Flynn, Programme Manager OES**

**26th September 2017**

**OFFICE OF ENVIRONMENTAL SUSTAINABILITY**

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

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| TO: | DIRECTORS |
| FROM: | Brian Meaney - Environmental Licensing Programme |
| DATE: | 25 September 2017 |
| RE: | Application for a Certificate of Authorisation from **Cork County Council** for a closed landfill at **Kealanine**<br>Certificate of Authorisation Register Number **H0089-01.** |

## 1. Application details

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| Type of facility: | Closed landfill[1], as defined in the Regulations[2] |
| Risk category of closed landfill: | High risk (class A)<br>• Reason: Risk of leachate migration through surface water pathway<br>Following an environmental risk assessment, the applicant revised the risk category to moderate. |
| Section 22 register number: | S22-02405 |
| Application received: | 1/8/2014 |
| AA screening determination: | 15/12/2016, published to EPA website, NIS was not sought |
| Regulation 7(4) notice: | 15/12/2016 |
| Additional information received: | 22/12/2016, including risk assessment dated June 2014 |

[1] "Closed landfill" means a landfill site operated by a local authority for the recovery or disposal of waste without a waste licence on any date between 15 July 1977 and 27 March 1997 (i.e. prior to the entry into force of the Waste Management (Licensing) Regulations 1997 (S.I. No. 133 of 1997).

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

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| Name of Qualified Person: | Larry O'Toole, RPS<br>Chartered Member of Engineers Ireland |
| EPA site inspection: | None |

## 2. Information on the closed landfill

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| Location of facility: | Kealanine (Kealinine), situated in Co. Cork between Glengarrif (5km) and Bantry (7km), 1.5km off the N71 primary route that connects them.<br>The landfill is on the southern slopes of Cobduff (380mOD) at an elevation between 109m and 119m.<br>See Figure 1 and Figure 2 below. |
| Period of landfilling: | Ceased in November 1997. |
| Surrounding area: | The landfill is located in a rugged area with bedrock outcrops forming ridges separated by areas of blanket peat. Rough grazing of horses and sheep is carried out.<br>A stream running along the southern boundary predates the development of the landfill.<br>The nearest house is within 400m to the east and another is some 450m away. The next nearest house is 750m. |
| Area of the closed landfill: | 1.82 hectares |
| Quantity of waste at the facility: | 90,000$m^3$ estimated |
| Characterisation of waste deposited: | Municipal waste, industrial waste and hazardous waste, including wastewater sludge, end-of-life vehicles, offal and oily waste.<br>Some oily waste from the Whiddy Island disaster in 1979 was blended with municipal waste and deposited in the eastern section of the landfill.<br>Site investigations turned up plastic bags, refuse sacks, packaging, glass, ceramics, metal and timber. |

## 3. Site investigations

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| Current condition and appearance of closed landfill: | According to the risk assessment (2014), the perimeter fence is in poor condition with no gate and no barrier to entry.<br>Temporary cover was applied to the landfill in 1999 comprising 20 to 30cm of topsoil which was compacted and seeded. Some waste has since been exposed along sheep tracks. Vegetation is well established including rushes over the top and sides of the waste mound and has been since 2005. There is scrub-like vegetation in places on the side slopes. There are well-established trees on the northern and southern side slopes.<br>Side slopes are steep, up to 1:2. The waste mound is 7.5 to 10.5m higher than surrounding natural ground. |

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| Site investigations: | Geophysical survey, 2010. Indicated 10-12m of waste, the bottom 2-4m of which has penetrated into underlying peat and silt. Possible hydrocarbon zones were identified as well as zones of commercial and domestic waste. There is evidence of a clayey bund along northern and western faces of the landfill. The bund was later shown to have a permeability of $1.78 \times 10^{-8}$ m/sec. The geophysics showed no evidence of leachate migration.<br><br>Intrusive site investigation, 2011, including rotary drilling (3 no.), boreholes (4 no.), slit trenches (2 no.) and hand augering (3 locations). Summary results as follows:<br><br>A borehole drilled through the centre of the site found 9.5m depth of waste and made ground, under which was peat (0.8m) on sandy gravel (1.2m) on bedrock. Water, taken to be the leachate level, was encountered at 7.5m below ground level.<br><br>Another borehole towards the side of the landfill found municipal waste to a depth of 6.8m and water at a depth of 4.5m.<br><br>A third borehole found waste to a depth of 8.5m, over a peat/waste mixture to 9m, over clayey sandy gravel to 9.7m and bedrock at 10.2m. Water was found at depths of 3.5m and 7.4m. There was visual and olfactory evidence of hydrocarbons.<br><br>A fourth borehole found waste to 7m and hydrocarbon sludge between 6.5m and 7m depth. Peat with a hydrocarbon odour was found to 7.3m. Water was found at 6m depth.<br><br>A fifth borehole found waste to 4.2m (the bottom of the hole) and industrial and hydrocarbon sludge at 4m depth. Water was found at 2.7m.<br><br>Investigations show a cap 0.3-0.5m thick and containing occasional waste. One sample of the cap was tested and showed a permeability of $6.8 \times 10^{-6}$ m/sec.<br><br>Iron staining of one soil sample (of two taken) at the foot of the landfill cap suggested leachate seepage. |
| Monitoring and analysis of samples (water, gas, waste): | For the original risk assessment:<br><br>• One round of gas sampling was done at 4 locations.<br>• Leachate samples were taken at 2 locations.<br>• Eluate testing was carried out on 2 waste samples.<br>• Surface water was sampled in 7 locations.<br>• Groundwater was sampled in 2 locations.<br>• Soil was sampled in 2 locations.<br><br>Supplementary groundwater, surface water, leachate and gas monitoring was done in February 2014. |
| Hydrology: | A stream runs along the southern boundary of the landfill, minimum 15m from the base of the waste mound. The stream is highlighted in Figure 1. It rises 50m upstream of the landfill. Surface water run-off from the mountain above the landfill skirts around the landfill before flowing into the stream.<br><br>There are drains constructed to collect surface water at the landfill site. These drains go to ground in a boggy area some 30m short of the stream.<br><br>The stream flows east for 2.5km to the Coomhola River. This river discharges 1.6km downstream to Inner Bantry Bay. |

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| | An EPA monitoring station on the Coomhola River at Coomhola Bridge, 1.5km upstream of the confluence with the stream, indicates high status (Q4-5). |
| Hydrogeology: | Drilling logs show high groundwater vulnerability under and around the landfill. The bedrock beneath the landfill is classed as Locally Important Aquifer (Ll) which is moderately productive only in local zones. Regional groundwater flow is expected to be eastwards, similar to surface water flow. Run-off is expected to discharge rapidly to water courses via upper layers of the aquifer. Short groundwater flow paths are typical, 30m to 300m, with groundwater discharging rapidly to surface water.<br>The Beara Sneem Groundwater body has a WFD risk score of 1a, i.e. at risk of not achieving good status. The risk score is said by the applicant to be unrelated to the landfilling activities.<br>Extreme groundwater vulnerability is indicated by the GSI vulnerability map and is borne out locally at the landfill by site investigations.<br>Naturally elevated iron and manganese are expected although the risk assessment found that landfill leachate was leading to higher-than-background concentrations in some groundwater and surface water locations.<br>Local residences use private wells for drinking water but their distance from the landfill coupled with short groundwater flow paths mitigates the risk of contamination of drinking water caused by the landfill. |
| Leachate and water quality: | It is evident that leachate migration is occurring to the surface water drains in the vicinity of the site as evidenced by iron staining and a visible sheen on ponded water within the site. Groundwater flow patterns indicate that leachate seepage will rapidly make it to surface water drainage.<br>Leachate analysis indicates elevated ammonia, manganese and PAHs.<br>Eluate analysis on waste samples showed elevated ammonia, manganese and hydrocarbons.<br>Generally, the leachate strength is deemed low compared to typical landfill leachates.<br>Analysis of surface water samples, taken from water courses and locally ponded areas, indicates the main parameters of concern are ammonia, iron, manganese and hydrocarbons. Whilst local impacts are evident, the surface water quality returns to background levels 400m downstream of the landfill.<br>Analysis of groundwater samples, representing background and impacted areas, indicates the main parameters of concern are ammonia, iron, manganese and hydrocarbons. It is concluded that leachate is not significantly impacting groundwater quality. |
| Landfill gas: | An elevated concentration of methane was found at one location in 2011. At 20% v/v, this is greater than the upper explosive limit of 5% v/v. Three other locations measured from zero to 2.1% v/v.<br>Further monitoring in 2014 showed significantly elevated concentrations (10-43% v/v) at 4 locations, indicating that landfill gas continues to be generated in significant quantities.<br>There are no potential receptors within 400m of the site. |
| Conceptual site model: | The conceptual site model is shown in Figure 3. |

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| | Source:<br>Rainfall on the landfill will preferentially percolate through the cap and into the waste.<br>Leachate is generated in the waste albeit at low strength.<br>Gas is generated at the landfill, primarily localised in the area of hydrocarbon disposal.<br>Pathway:<br>Leachate can migrate through the base of the landfill into peat, sand and gravel and bedrock layers beneath.<br>Surface seeps of leachate discharge to local drainage ditches.<br>Dominant flow pattern for groundwater is to discharge within a short distance to surface water.<br>Gas migration can occur through the permeable cap and in the sand and gravel deposits and fractured bedrock beneath the waste.<br>Receptors:<br>All houses are served by private wells. There are three located between 400m and 1,000m of the landfill.<br>The bedrock aquifer has low potential for groundwater resources development.<br>Leachate discharges directly or via groundwater to a local stream which flows to the Coomhola River. The local stream is the dominant receptor for waterborne contamination. Water quality improves to background levels prior to its confluence with the Coomhola River.<br>There are no receptors for gas migration. |

## 4. SPR linkages and remedial actions

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| SPR linkage scenarios (applicable ones only): | **Leachate migration through combined groundwater and surface water pathways**<br>SPR 1, Receptor = surface water body.<br>**Leachate migration through groundwater pathway**<br>SPR 3, Receptor = private wells.<br>SPR 5, Receptor = aquifer.<br>SPR 7, Receptor = surface water body<br>**Leachate migration through surface water pathway**<br>SPR 8, Receptor = surface water body<br>**Summary:**<br>Notwithstanding the risk to private wells and the aquifer, local conditions indicate that leachate migration into groundwater will likely remain shallow and quickly re-emerge into surface water via drains or directly into waterbodies. |
| Proposed remedial actions: | The remediation principles are as follows and are subject to detailed design.<br>The objective is to address the risk of leachate discharging (via groundwater and local drains and streams) into surface water bodies. |

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| | A low permeability cap is proposed and will reduce rainfall infiltration and the generation of leachate. The proposed cap will include:<br>• topsoil and subsoil, minimum 500mm;<br>• drainage layer, permeability 1 x $10^{-4}$m/s, 500mm;<br>• compacted mineral layer, permeability 1 x $10^{-9}$m/s, 600mm, or geosynthetic material that provides equivalent protection;<br>• gas collection layer, 300mm.<br>The EPA Landfill Restoration and Aftercare Manual recommends a topsoil and subsoil layer of at least 1 metre depth. A smaller depth is proposed in this instance and is considered sufficient by the applicant because:<br>• it is sufficient to protect the underlying layers;<br>• no trees will be planted;<br>• the site will not be developed as a public amenity;<br>• low intensity grazing will be carried out after a sward develops.<br>The proposed soil thickness in fact corresponds to the EPA's recommended cap for an inert waste landfill with no capping layer or gas control system.<br>Some regrading of the existing cap will take place. Reprofiling of side slopes and shape of top will facilitate rainwater run-off and reduce ponding and infiltration.<br>Gas will be vented passively through the cap. Perimeter gas collection trenches will also be constructed and passive vents installed.<br>Stock proof fencing will be installed for at least the duration of works and for a period after to allow for grass sward establishment.<br>It is intended to break the SPR linkages such that the driving force is reduced (rainfall infiltrating the waste) leading to less leachate (and its contaminants) being discharged into surface water and groundwater.<br>Estimated cost: €350,000 – 400,000.<br>The draft Certificate of Authorisation allows for the importation and use of waste soil and stone to complete the works. |
| Proposed aftercare monitoring and assessment: | Monitoring as specified in condition 3.4 of the recommended certificate of authorisation.<br>Validation report to be submitted within 30 months. |

## 5. **Recommendation**

I recommend granting the certificate of authorisation as proposed, thereby authorising the remedial actions recommended by the Qualified Person.

Signed

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Brian Meaney

## Procedural Note

Any representations received by the Agency from Cork County Council 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 closed landfill (yellow boundary) on the side of the Cobduff mountain.**

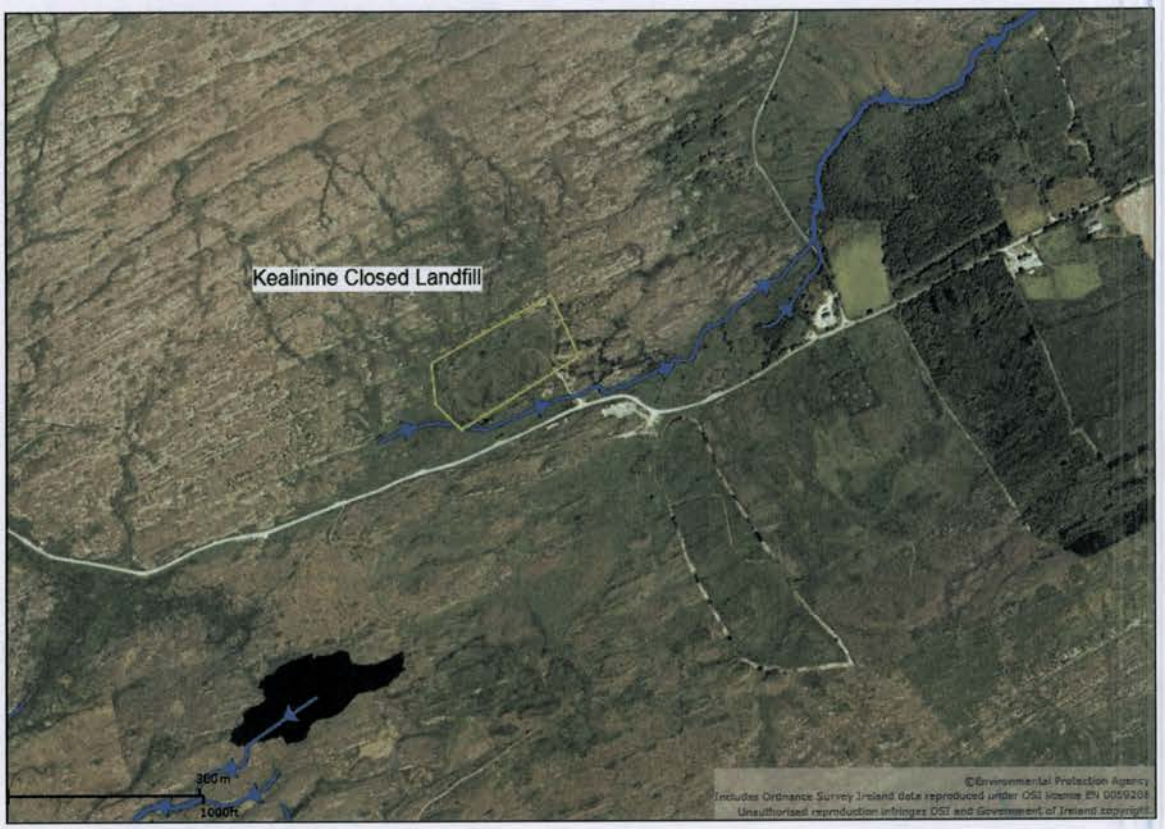


**Figure 2 Location of closed landfill, towards the right middle of the image – Glengarriff is to the west and Bantry Bay is the major coastal water body shown**

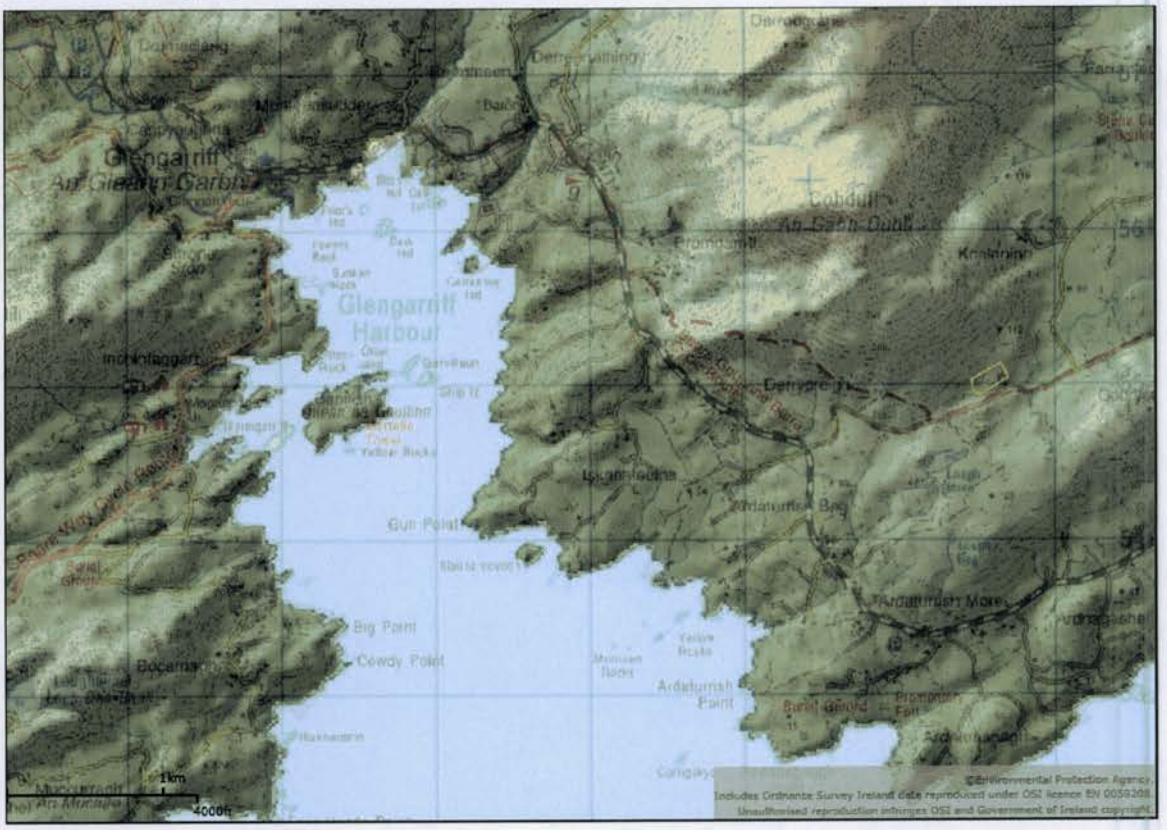

**Figure 3 Conceptual site model**

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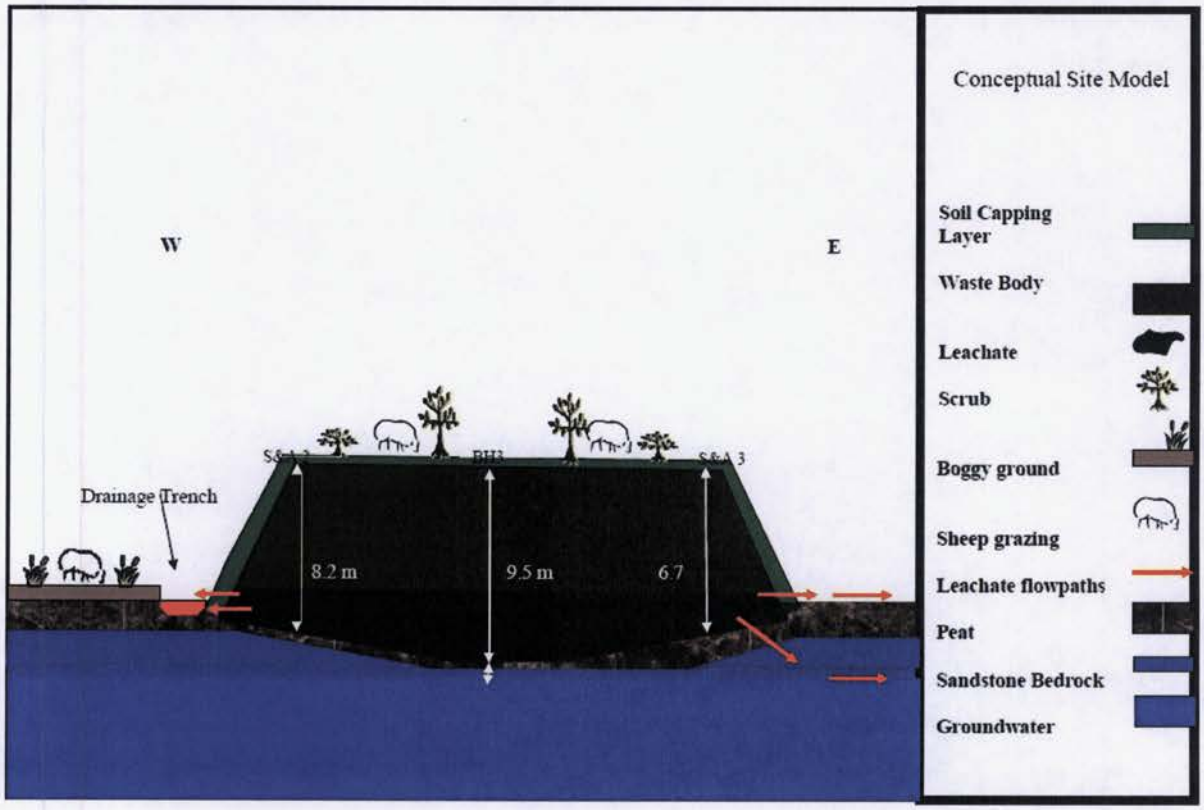


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