

ATTACHMENT A.1.

NON – TECHNICAL SUMMARY

APPLICATION TO THE EPA FOR A CERTIFICATE OF AUTHORISATION

FORMER MUNICIPAL HISTORIC LANDFILL

POTTLEBOY

COOTEHILL

CO. CAVAN

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1.0 INTRODUCTION

Cavan County Council has completed a Tier 1 risk assessment for the closed former historic landfill located at Pottleboy, Cootehill, Co Cavan in accordance with the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008). Further to this, Traynor Environmental Ltd in conjunction with the Waste Management Section of Cavan County Council has prepared a Tier 2 and Tier 3 risk assessment for the site. Cavan County Council must apply to the Environmental Protection Agency (EPA) for a certificate of authorisation in respect of this risk assessment.

Traynor Environmental Ltd was appointed by Cavan County Council to prepare the documentation for the application.

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2.0 SITE DESCRIPTION

2.1. LOCATION AND BRIEF DESCRIPTION

Cootehill Historic landfill is located approximately 0.8 km from the centre of Cootehill town, in the townland of Pottleboy on local roadway L - 6088-0 Ref: Drawing No. 14.248.101 - Site Location Map in Appendix F. The land surrounding the site slopes (uphill) moderately in a North Easterly direction towards the town of Cootehill. It is bounded on the North and South by urban dwellings and to the west and east by Agricultural Land. The historic landfill site located at Pottleboy in Cootehill is directly linked to a small parcel of land not in the ownership of Cavan County Council. There is no fence or hedgerow delineating the boundary between the two sites. However from the Tier 2 investigation it has been established that the majority of historical waste present is located within the boundary of land owned by Cavan County Council. The adjoining parcel of land owned by Patrick and Siobhan Shields, located to the east contained some surface waste but would be deemed insignificant.

The main receptors close to the historic landfill site are dwelling houses and a community Crèche. Drummarket housing estates to the South and the Community Crèche to the north west of the site are both in close proximity to the site and thus lateral landfill gas migration would pose a potential risk. The housing estate and Community Crèche are served by Cootehill water supply. The landfill site encompasses an area of approximately 0.18 ha and the adjoining site to the east is 0.10 ha. The boundaries are marked by local road (L-6088-0) to the South and Southwest. The area to the West and East consist of agricultural land. The land to the Southeast is an unmaintained forested and overgrown site. The historic landfill site is currently unused and over grown with vegetation. The site is unsecured and does not currently have any fencing on the perimeter.

2.2. SITE HISTORY

It is understood that waste disposal began at the site in August 1967 (approximate date). A variety of wastes may have been deposited, including Municipal Solid Waste (MSW) and Construction and Demolition (C&D) wastes. It is thought the landfill mainly accepted municipal waste from the surrounding area. The landfill was finally closed on the 19th April 1985. A review of the Ordnance Survey Ireland (OSI) revealed a good selection of historical maps for the site ranging from 1888 to the present day. Colour and black/white aerial photographs were also reviewed. The following maps/aerial photographs were used to show changes of usage on the site: (Ref to Appendix F for drawings) The outline of the landfill and its waste material can be observed on aerial photography 1995 (Drawing No. 14.248.104 Appendix F of the Tier 2 Risk Assessment). Aerial photograph from 2000 (Drawing No. 14.248.103 - Appendix F of the Tier 2 Risk Assessment), shows the site to contain large amounts of overgrown vegetation and bedrock was encountered at shallow depths.

The lateral extent of the waste covers an area of approximately 1700m². It is estimated, that approximately 3740 tonnes of waste is deposited at the site. Following site investigations it was discovered that the waste encountered comprises of a large variety of wastes including plastics, paper, glass, metal and textiles all of which were supported by a stony clay matrix. The nature of waste is typical of municipal waste that has been buried for over 20 years which has undergone considerable biodegradation.

3.0 HYDROLOGY AND HYDROGEOLOGY OF THE SITE

3.1. HYDROGEOLOGY

The GSI, EPA and the Department of the Environment, Community and Local Government (DOECLG) have developed a programme of Groundwater Protection Schemes (GPWS) with the aim of maintaining the quality and quantity of groundwater in Ireland, and in some cases improving the groundwater quality, by applying a risk assessment approach to groundwater protection and sustainable development. From the GPWS for the area it is evident that the bedrock aquifer underlying the site has a classification of "Poor Aquifer" – Bedrock which is generally unproductive except for local zones (Drawing No. 14.248.106 - Appendix F of the Tier 2 Risk Assessment). The Geological Survey of Ireland has classified the vulnerability of the aquifers within the region as Extreme (Rock at/near surface or Karst) and Extreme to the northwest of the site. According to the GSI Well Database, there are seven wells within 2.0 km of the site. Refer to Table 1, Well data and location in the vicinity of Cootehill.

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Table 1: Well data and location in the vicinity of Cootehill 1 - 5

Groundwater Well Data No. 1 - 5								
Well Ref. No.	Approx Distance From Site (Km)	Direction away from site	Use	Yield Class	Yield m ³ /day	Depth (metres)	Depth to Rock (metres)	Grid Ref.
No. 1	1.45 km	North West	Agri & Domestic	Poor	16.3	56.4	3	259570 314420
No. 2	1.2 km	North West	-	Moderate	54.5	61	6.7	259910 314290
No. 3	1.1 km	North West	Agri & Domestic	Good	65	36.6	16.5	259900 314220
No. 4	1.0 km	North West	Agri & Domestic	Poor	34.5	63	1	259990 314260
No. 5	0.75 km	North West	Agri & Domestic	Poor	34.6	105	10	260070 313990

Locations of Wells in the vicinity of Cootehill Landfill.			
Map Legend: Distance of well accuracy within (m) Meters/ (km) Kilometers			
1 km	500 m	100 m	10 - 50 m

Source of Map: Geological Survey of Ireland-Online Mapping - Groundwater Public Viewer

Table 1A: Well data and location in the vicinity of Cootehill 6 - 7

Groundwater Well Data No. 6 - 7								
Well Ref. No.	Approx Distance From Site (Km)	Direction away from site	Use	Yield Class	Yield m ³ /day	Depth (metres)	Depth to Rock (metres)	Grid Ref.
No. 6	1.4 km	South East	Agri & Domestic	-	-	5	5	261520 312430
No. 7	1.9 km	South East	Agri & Domestic	-	-	5	1	262600 313140

Locations of wells in the vicinity of Cootehill Landfill.	
Map Legend: Distance of well accuracy within (m) Meters/ (km) Kilometers	
1 km	
500 m	
100 m	
10 - 50 m	

Source of Map: Geological Survey of Ireland-Online Mapping - Groundwater Public Viewer

Groundwater Vulnerability

The GSI vulnerability map (www.gsi.ie) indicates that the vulnerability rating within the site is Extreme (Rock at/near surface or Karst) (Drawing No 14.248.107 - Appendix F). The vulnerability mapping is based on the response matrix for landfills (as summarised in Table 2 below), which assigns a vulnerability rating depending on the characteristics of the overburden deposits, the thickness of the strata and in the case of drift aquifers, depth of the unsaturated zone. Taking account of the fact that the aquifer is a poor aquifer coupled with the vulnerability level an R2² response is recommended. The level of response depends on the different elements of risk; the vulnerability, the value of the groundwater and the contaminant loading. A response level of R2² is acceptable in principle depending on the zone and activity. All the above facts would minimise the impact on groundwater resources.

Table 2: Response Matrix for Landfills

VULNERABILITY RATING	SOURCE PROTECTION AREA		RESOURCE PROTECTION					
			Aquifer Category					
	Inner (SI)	Outer (SO)	Regionally Important (R)		Locally Important (L)		Poor Aquifer (P)	
Rk			Rf/Rg	Lm/Lg	L1	PI	Pu	
Extreme (E)	R4	R4	R4	R4	R3 ²	R2 ²	R2 ²	R2 ¹
High (H)	R4	R4	R4	R4	R3 ¹	R2 ¹	R2 ¹	R1
Moderate (M)	R4	R4	R4	R3 ¹	R2 ²	R2 ¹	R2 ¹	R1
Low (L)	R4	R3 ¹	R3 ¹	R3 ¹	R1	R1	R1	R1

Source of Map: www.gsi.ie - Responses Matrices for Groundwater Protection Schemes

R2² Acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence.

- Special attention should be given to checking for the presence of high permeability zones. If such zones are present then the landfill should only be allowed if it can be proven that the risk of leachate movement to these zones is insignificant. Special attention must be given to existing wells down gradient of the site and to the projected future development of the aquifer.

3.2. HYDROLOGY

Historic maps from the Department of Communications, Energy and Natural Resources and the Geological Survey of Ireland were examined for hydrological information relating to the site. A site walk over was also conducted as part of the Tier 1 Risk Assessment. From this combined research it has been ascertained that, Pottleboy Stream flows along the northern and western boundary of the landfill site and is piped for approximately 90-100m, it then reemerges across the road under the bridge. Q value ratings of the watercourse/drains was used to assess the water quality upstream and downstream of the landfill site. No water table was encountered on the site.

4.0 ECOLOGY OF SITE AND SURROUNDING AREA

The Ecological Report carried out by Noreen McLoughlin MSc MIEEM. is included in Appendix B of the Tier 2 Assessment. The ecological assessment of the landfill site at Pottleboy was carried out using aerial photographs, ground photographs and historical maps in conjunction with a site walkover. After consultation with National Parks and Wildlife Service website it was ascertained that there are no designated sites adjacent to or close to the site of the old landfill. The main habitats identified on the site are scrub and unimproved grassland. The boundary along the northern perimeter of the site is comprised of a treeline / hedgerow, this appears to be an original fence.

5.0 POTENTIAL RISKS

5.1. RISK CATEGORY

The site was classified as Class B - Moderate Risk, after the Tier 1 Risk Assessments. After the Tier 2 risk assessment the classification remained the same, Class B - Moderate Risk in accordance with the Code of Practice Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA 2007).

5.2. ACTUAL AND POTENTIAL ENVIRONMENTAL IMPACTS

The following environmental impacts were considered when undertaking the site risk assessment:

5.2.1 *Surface Water Contamination –Actual Environmental Impacts*

Pottleboy Stream is located along the northern and western boundary of the site, however this section of the stream is piped and surface water monitoring has shown no impact on the quality of the water body.

5.2.2 *Surface Water Contamination –Potential Environmental Impacts*

Road drainage culverts outside the footprint of the landfill could potentially be at risk from works and potential run-off. The removal of waste could mobilize polluting compounds which are currently bound within the waste/clay matrix of the landfill. Mitigation measures to reduce the risk to Pottleboy stream during remediation would be necessary.

5.2.3 Groundwater Contamination – Actual Environmental Impacts

There was no groundwater encountered during the risk assessment investigations of Cootehill historic landfill. The waste is not saturated and no water/groundwater and/or leachate were encountered in any of the trial holes. The majority of the waste is underpinned by the bedrock which would potentially allow the downward movement of any leachate resulting in preferential flow to groundwater. Leachate would have discharged from the waste body over time.

5.2.4 Groundwater Contamination – Potential Environmental Impacts

The movement of the waste by an excavator during remediation works could potentially lead to the vertical movement of contaminants to groundwater.

5.2.5 Landfill Gas Migration -Actual Environmental Impacts

A comprehensive regime of landfill gas monitoring was completed on site. Landfill gas was monitored on 15 No. occasions between 28th October 2014 and the 27th November 2014. Readings were collected using a GA 2000 landfill gas analyser. From analysis of the gas monitoring results Gas Well No. 8 (GW8) showed the highest levels for methane. Negligible amounts of methane concentrations were evident in all of the other gas well monitoring locations. This indicates that low levels of landfill gas are being generated from the biodegradation of the waste.. Therefore the current environmental impact of landfill gas migration is negligible. Extended Gas monitoring was also carried out as part of the Tier 2 Risk Assessment

5.2.6 Landfill Gas Migration - Potential Environmental Impacts

Landfill gas monitoring was also carried out during the Tier 3 Risk Assessment. The main objective of this monitoring was to reaffirm the findings of the Tier 2 assessment; that there is no immediate or long term risk of landfill gas migration to offsite receptors from Cootehill historic landfill. The risk posed by landfill gas to off-site receptors is considered to be negligible.

5.2.7 Human Beings - Actual Environmental Impacts

Currently the waste material is bound within the landfill and covered with a thin cap layer. The material appears stable, immobile and situated on bedrock. Human presence is considered to be the principal sensitive receptor with respect of landfill gas migration. This is due to the potential for the accumulation of higher than normal levels of gas; however the risk posed by landfill gas to off-site receptors is considered to be negligible. No evidence of land fill gas migration was found during the Tier 2 investigations.

5.2.8 Human Beings - Potential Environmental Impacts

According to the GSI Well Database, there are seven wells within 2.0 km of the site. However due to no evidence of leachate present at the site, the potential risk to these wells is negligible. The housing estates are served by Cootehill Public water supply.

6.0 PROPOSED REMEDIATION WORKS

6.1 GENERAL

The Tier 2 Risk Assessment and trial hole investigations confirmed that landfill material consisted mainly of household waste. The waste material unearthed, comprised mainly of plastics, paper, glass, metal and textiles. There was no evidence of any potentially hazardous waste on site. The key objective of remediation, being cognisant of time, and health and safety constraints is to prevent the lateral migration of landfill gas to offsite receptors and minimise the impact on the environment.

The proposed measures considered for the historic landfill are as follows:

- Vent Trenches;
- Virtual Curtain System;
- Landfill Gas Monitoring;
- Passive Venting Wells and Capping of the Landfill;
- Removal of Waste Material, Re-grading of the Landform and Surface water Control.

6.2 SUMMARY OF MEASURES

6.2.1 Vent Trenches

A proposed vent trench system would consist of the excavation of a minimum 1.2m wide trench to the base of the fill material, i.e. 5 - 6 meters below ground level (mbgl). This trench would then be lined with a geotextile and backfilled with graded aggregate around 160 mm perforated, vertical pipes with filter sock installed at 1m centres. These pipes would be connected to a horizontal gas collection duct with vent stack manifolds and vertical risers as per the venting system. The vertical vent pipes should be proud of the capping material and should not be slotted at the point where they pass through the capping material.

Alternative Considered

Often combinations of both passive and active gas venting systems are used. However due to the low levels of landfill gas detected during the Tier 2 Risk Assessment, a combination of venting measure was not considered as an alternative. There are numerous gas control systems and the alternatives considered for use at the Cootehill historic landfill are outlined in section 3.2.4 Passive Venting Wells and 3.2.2 Virtual Curtain System.

Recommended Remediation Measure

A number of different gas venting systems have been considered as part of remediation options proposed for the site. From investigation carried out during the Tier 2 Risk Assessment, Cootehill landfill has shown to be in phase VII of the evolution of gas production over the lifetime of a landfill. This classification is due to the low volume and poor calorific value of the landfill gas detected. The installation of vent trenches is not considered necessary

or viable remediation option. The constraints of the site such as bedrock would also affect the installation and effectiveness of the vent trenches.

Timescale for Completion of Works

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would estimate a timeframe of 1 - 2 months for the installation of the appropriate number of vent trenches on the site. The said timescale for the installation of the system is dependent on a number of conditions such as no unforeseen problems during the excavation and installation works, available resources, appropriate weather conditions to carry out trench works.

6.2.2 Virtual Curtain System

This unique method utilises a series of individual vertically driven, highly voided geosynthetic vents that are positioned at calculated centres to create a linear, in-ground "Venting Curtain" gas barrier. The zone of influence and consequent designed spacing of each vent node is dependent on site specific ground conditions. Virtual Curtain, a proprietary remediation system used widely in the UK, was also considered for installation. This system consists of vent nodes constructed of a gas-permeable geocomposite material installed to the base of the fill material at 1m centres. A horizontal gas collection duct located within a shallow, gravel-filled trench connects the nodes. A prefabricated vent bollard, which vents the diluted landfill gases to the atmosphere, is installed every 10m along the horizontal gas collection duct. Diagram of a representative vent trench construction are shown in figure no. 5 of the Tier 3 risk assessment. Landfill gas monitoring would take place on both sides of the virtual curtain in order to show whether gas is reaching the barrier and also to test the effectiveness of the barrier.

Alternative Considered

There are numerous gas control systems and the alternatives considered for use at the Cootehill historic landfill are outlined in section 3.2.4 Passive Venting Wells and 3.2.1 Vent Trenches. Complete removal of all waste material from the site has also been considered. A programme of landfill gas monitoring may form part the remediation measure for the site.

Recommended Remediation Measure

Following consideration of the positive and negative effects associated with the installation of a virtual curtain and the site constraints it was not considered a suitable remediation measure for the Cootehill site. From extensive gas monitoring carried out during the Tier 2 and Tier 3 Risk Assessment it has been shown that negligible levels of landfill gas was detected at gas well No. 8 (GW 8) which is located in close proximity to the boundaries near the sensitive receptors. If waste material was present in this area or landfill gas detected it would be an ideal location for a virtual curtain system. Where low levels of landfill gas were detected the site is adjoined by the car park of the community crèche. A virtual curtain was not considered a suitable remediation for the site.

Timescale for Completion of Works

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd estimate a timeframe of 1 month for the installation of the Virtual Curtain system on the site. The said timescale for the installation of the system is dependent on a number parameter such as site constraints (bedrock), proximity to offsite receptors, weather and no unforeseen problems during the excavation.

6.2.3 Landfill Gas Monitoring

There is currently No. 9 Gas monitoring wells installed at the site. As part of a continued programme of monitoring it is proposed to install three additional gas monitoring wells at the site. These additional monitoring locations will be positioned according to the EPA Landfill Manuals - Landfill Operation Practices. In combination with the existing nine gas monitoring location the new gas monitoring locations will be positioned on both sides of the passive gas venting system in order to show:

- a) whether gas is breaching the gas venting barrier
- b) to test the effectiveness(or otherwise) of the gas venting system

6.2.4 Passive Venting Wells and Capping of the Landfill

Passive Venting Wells

During the Tier 2 and Tier 3 Environmental Risk Assessment landfill gas was detected at GW 8. The gas flow rates and levels of landfill gas (Methane and CO₂) recorded during recent monitoring were negligible. The preferential pathway for landfill gas is vertical. Landfill gas can be controlled by installing a passive venting system. A basic system may consist of simple venting trenches that release landfill gas into the atmosphere. A more sophisticated passive venting system may consist of a horizontal network of slotted HDPE pipes connected together and fed to vertical venting columns. Columns may be fitted with rotating aspiromatic cowl to provide a small vacuum and increase the efficiency of the extraction.

A proposed passive venting well system would consist of installation of 300 mm boreholes at 1 m centres to the base of the fill material and constructed with 160 mm diameter perforated vertical pipe with filter sock. All vertical pipes would be connected to a horizontal, 160mm diameter perforated pipe with filter sock located within a gravel-filled trench located in the top 1.0 meters below ground level (mbgl). Vent stack manifolds and vertical risers located at 10m centres along the horizontal gas collection duct would vent the landfill gases to the atmosphere. The efficiency of a passive collection system partly depends on how well the gas is contained within the landfill.

Re- Grading of Landform

The re-grading of the landform is vital to the overall remediation of the site and will break the infiltration of rainfall into the waste body. This re-grading will take place with whatever combination of gas venting system is carried out.

Capping

Capping of the landfill with a suitable capping layer will minimise the infiltration of precipitation into the waste body whilst allowing sufficient moisture to penetrate in order to maintain the decomposition process.

Low Permeability layer

The main function of this layer is the control of leachate generation by minimising the infiltration of water into the underlying waste. This layer should consist of a material which can be compacted to a suitably low hydraulic conductivity which prevents most, but not all, of the moisture infiltrating into the waste.

Subsoil

In addition to the low permeability layer a 400mm subsoil layer would be required across the capping layer in order to protect the low permeability layer and to help support vegetation. A loamy and relatively stone-free soil could be used for this layer.

Topsoil or Similar Layer

This layer is necessary to provide a foundation into which grass and any other vegetation might be planted. The topsoil or similar product should be uniform and have a minimum slope of 1 to 30 prevent surface water ponding.

Tree Planting and Final Landscaping

The landfill at Cootehill could be planted with a suitable mix of trees to ensure the establishment of a good sustained vegetative cover and aid the integration of the landfill into the landscape.

Alternative Considered

The exact nature of the infrastructure used to control landfill gas is site specific. The over-riding objective is to prevent landfill gas passing beyond the perimeter of the site, while protecting off site receptors and those using the lower part of the site (Cavan County Council). There are numerous gas control systems and the alternatives considered for use at the Cootehill historic landfill are outlined in section 3.2.1 Vent Trenches and 3.2.2 Virtual Curtain System.

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would consider a Passive Venting system as a potential remediation option for Cootehill landfill site. Due to the low levels of landfill gas detected and the proximity of sensitive receptors passive gas venting has merit as a remediation option for the site. Landfill Gas levels for Methane CH₄ have steadily decreased over the Tier 2 and Tier 3 Monitoring programme, however low levels were still detected. A Passive Venting System is therefore considered a viable remediation measure for Cootehill Historic landfill.

Timescale for Completion of Works

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd estimate timeframe of 1 - 2 months for the installation of the chosen passive venting system and capping of the

landfill. The said timescale for the installation of the system is dependent on resources available, weather conditions and no unforeseen problems during the excavation and installation works.

6.2.5 Removal of All Waste Material, Re-grading of the Landform and Surface water Control/Management

The removal of all waste material from the historic landfill would ultimately remove the source of contamination from the site and the environment as a whole. However the potential removal of the waste material from the site poses a number of potential risks. The physical act of removing the waste could potentially mobilise contaminants which are dormant within the site and aid their migration. The removal of the waste could create airborne particulates in the vicinity of the work area. Workers immediate to the work area and residents downwind of the site could be negatively impacted by the dig-out and removal of the waste material. The cost for the removal of the waste would be considerable as the waste would have to be removed and transported to a licensed facility. The estimated tonnage for dig-out and removal is 3740 Tonnes.

Re-grading of the Landform

The re-grading of the landform is vital to the overall remediation of the site and its future use as a possible amenity area for the community or neighbouring businesses e.g. the community crèche. The re-grading of the site would have a positive effect on the following:

- Enhanced surface water drainage;
- General landscaping and visual impact of the site.
- Potential use for the local community

The main aspect of the re-grading is to re-integrate the site into the existing built environment and maximise its future potential use as an amenity for the local community. The final landform must have watersheds which will direct surface water towards the surrounding surface water drainage system. Re-grading of the Landform with a suitable material will result in the complete remediation of the site.

A 300mm subsoil layer would be required in order to support vegetation and creates a platform for the top soil layer. A loamy and relatively stone-free soil could be used for this layer. Alternatively if option 2 above were chosen, remaining clay fines left after screening could be used as the subsoil layer.

Surface water Control and Management

The landfill is currently capped with a thin layer of soil/aggregate, through which precipitation freely entering the waste body. The removal of the waste will require the soil cover to be stripped. Removal of soil cover will increase the vulnerability of the underlying bedrock. It is envisaged that any soil excavated will be retained on site and reused as fill material and landscaping. Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving watercourse. The control of surface water runoff, which is likely to contain increased loads of suspended solids, will be by the use of mitigation measures such as bunds, settlement ponds, silt fences, or by covering the stockpiles with plastic sheeting. In addition, water sprays will be used to avoid the generation of dust during dry weather. Refuelling operations will only take place at a designated, bunded area of hard standing that is situated as far away as possible from surface water bodies.

Alternative Considered

Leaving the waste in-situ and monitoring the levels of Landfill Gas was also considered as an option for remediation, given the nature of the site and fill material encountered. Gas venting systems such as passive venting wells, vent trench and virtual curtain were also considered as an alternative to removal of waste material. Lining and capping of the landfill would also form part of the remediation works in conjunction with gas venting measures.

Recommended Remediation Measure

Following consideration of the positive and negative effects from the complete removal of all waste material, the Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would recommend the complete dig-out and removal of waste from Cootehill historic landfill. The site specific characteristics of Cootehill landfill and monitoring results from the tier 2 and tier 3 risk assessments indicate that, the small site area (0.18 ha), estimated volume of waste encountered, very low levels of Landfill gas recorded, and the site location would justify the complete removal of the waste material from the site. This is considered to be the most appropriate remediation technique for the site by Cavan County Council. The proximity of a fully licensed municipal landfill which could accept the waste material once removed was also considered economical favourable when recommending this remediation option.

Based on a logistical programme, cost considerations and landfill gas levels/ and concentrations, the removal of all the historic waste, presents the most viable remedial option for the site. Final tonnages of waste will be determined after screening of the material has taken place as detailed in option 1 and 2 above.

Timescale for Completion of Works

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would estimate a timeframe of 4 - 5 months for the dig-out and removal of waste material from the site. The said timescale for the removal of the waste is dependent on resources available, weather conditions and no unforeseen problems during the excavation works e.g. encountering additional quantities of hazardous waste, which were not unearthed during the trial hole excavation.

7.0 SUMMARY OF ALL REMEDIATION MEASURES

The Tier 2 Risk Assessment process has resulted in the risk rating for the historic landfill remaining the same which is, Moderate Risk (Class B). SPR Linkage number 10 has been proven and thus risk rating assigned accordingly as **Moderate**. As part of the Tier 2 risk assessment the intrusive site investigation works have confirmed the area where the waste was deposited is the same as previously predicted, accounting for approximately 1700m². This represents approximately 3740 tonnes of waste deposited at the site. This has resulted in no change to the SPR linkages after the tier two.

Five key remediation options have been proposed, in relation to the historic landfill at Cootehill. The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd recommends option 3.2.5 "Removal of Waste Material, Re-grading of the Landform and Surface water Control/Management" as the most suitable and economical viable remediation option for the site.

8.0 CONCLUSION AND RECOMMENDATIONS

8.1 CONCLUSION

The Tier 2 Exploratory and intrusive investigations identified that there was waste encountered in trial holes TH1, TH2, TH3 TH4, TH5, TH6, TH7, TH8, TH9, TH10, TH11, TH12, TH13, TH14, TH15, TH22, TH23, TH24 and TH 25. at the historic landfill located at Pottleboy, Cootehill Co. Cavan.

Pottleboy Stream flows along the northern and western boundary of the landfill site and is piped for approximately 90-100m, it then reemerges across the road under the bridge. Q value ratings of the watercourse/drains were used to assess the water quality upstream and downstream of the landfill site. No evidence of pollution to the stream was evident from monitoring carried out. No groundwater was encountered during trial hole excavations therefore no groundwater sampling took place.

The bedrock aquifer underlying the site has a classification of "Poor Aquifer" – Bedrock which is generally unproductive except for local zones. The Geological Survey of Ireland has classified the vulnerability of the aquifers within the region as extreme (Rock at/near surface or Karst). Taking account of the fact that the aquifer is a poor aquifer coupled with the vulnerability level an R2² response is recommended.

Nine Gas Wells were strategically located around the site. Gas Wells GW5 and GW6 were placed in the centre of the site where a high percentage of waste was encountered during the site investigation works. GW7, GW8 and GW9 were located on the northern and western boundary of the site adjacent to the community Crèche. GW2, GW3 and GW4 were located along the eastern edge of the landfill site which also defines the edge of the waste. GW 1 was located outside the waste body in the most easterly aspect of the neighbouring site and was be monitored for landfill gas as a control.

Extended gas monitoring was completed at all No. 9 gas monitoring wells (refer to table for results and graphs in appendix E of the Tier 2 Risk Assessment). The main objective of the extended gas monitoring was to reaffirm the findings of the Tier 2 assessment; that there is no immediate or long term risk of landfill gas migration to offsite receptors from Cootehill historic landfill.

The Tier 2 Risk Assessment process has resulted in the risk rating for the historic landfill remaining as Moderate Risk (Class B). SPR Linkage number 10 has been proven and thus risk rating assigned accordingly as **Moderate**. As part of the Tier 2 risk assessment the intrusive site investigation works have confirmed the area where the waste was deposited is the same as previously predicted, accounting for approximately 1700m².

8.2 RECOMMENDATIONS

Following consideration of the positive and negative effects from the complete removal of all waste material, the Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would recommend the complete dig-out and removal of waste from Cootehill historic landfill. The site specific characteristics of Cootehill landfill and monitoring results from the tier 2 and tier 3 risk assessments indicate that, the small site area (0.18 ha), estimated volume of waste encountered very low levels of Landfill gas recorded, would justify the complete removal of the waste material from the site. This is considered to be the most appropriate remediation technique being mindful of cost considerations and environmental impact.

Based on a logistical programme, cost considerations and landfill gas levels/ and concentrations, the removal of all the historic waste, presents the most viable remedial option for the site.

The re-grading of the site is vital to the overall remediation of the site and the potential re-use of the site by the local community. This re-grading will take place after remediation option 3.2.1 Removal of the Waste Material has been complete. The final contour plan for the site, prior to re-grading of the landform will be agreed with the Environmental Protection Agency (EPA)/Local Authority.

Subject to remediation measures being carried out, the risk rating for Cootehill Historic Landfill would be reduced from a Moderate Risk to a **Low Risk** site as all of the SPR linkages would have been broken. The SPR Linkage diagrams for each option have been detailed under each section.

Taking into consideration the future costs of monitoring, maintenance and venting of landfill gas the removal of the waste from the site represents a complete and comprehensive remediation option for the site.

8.3 SPR LINKAGES AFTER REMEDIATION WORKS CARRIED OUT**Table 3: SPR Linkages If Remediation Works Carried Out On Site As detailed In Option A Tier 3 Environmental Risk Assessment Report**

Risk Equation	SPR Values	Max Score	Linkages	Normalised Scores (%)
SPR 1 = $1a \times (2a + 2b + 2c) \times 3e$	0	300	Leachate → Surface Water	0.00
SPR 2 = $1a \times (2a + 2b + 2c) \times 3b$	0	300	Leachate → SWDTE	0.00
SPR 3 = $1a \times (2a + 2b) \times 3a$	0	240	Leachate → human Presence	0.00
SPR 4 = $1a \times (2a + 2b) \times 3b$	0	240	Leachate → GWDTE	0.00
SPR 5 = $1a \times (2a + 2b) \times 3c$	0	400	Leachate → Aquifer	0.00
SPR 6 = $1a \times (2a + 2b) \times 3d$	0	560	Leachate → Surface Water	0.00
SPR 7 = $1a \times (2a + 2b) \times 3e$	0	240	Leachate → SWDTE	0.00
SPR 8 = $1a \times 2c \times 3e$	0	60	Leachate → Surface Water	0.00
SPR 9 = $1a \times 2c \times 3b$	0	60	Leachate → SWDTE	0.00
SPR 10 = $1b \times 2d \times 3f$	0	150	Landfill Gas → Human Presence	0.00
SPR 11 = $1b \times 2e \times 3f$	0	250	Landfill Gas → Human Presence	0.00

Risk Classification	Score Range
High Risk (Class A)	Greater than or equal to 70% for any individual SPR linkage
Moderate Risk (Class B)	Between 40% and 70% for any individual SPR linkage
Low Risk (Class C)	Less than or equal to 40% for any individual SPR linkage

Overall Risk after Completed Remediation Works	Low Risk (Class C)
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