ATTACHMENT A.1.

NON – TECHNICAL SUMMARY

APPLICATION TO THE EPA FOR A CERTIFICATE OF AUTHORISATION

FORMER MUNICIPAL HISTORIC LANDFILL

RANTAVAN

MULLAGH

CO. CAVAN

Prepared By:

Traynor Environmental Ltd
Belturbet Business Park,
Creeny
Belturbet
Co. Cavan

Traynor Environmental Ltd.

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1. INTRODUCTION

Cavan County Council has completed a Tier 1 risk assessment for the closed of the former historic landfill located at Rantavan, Mullagh. 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 1, 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.

2. SITE DESCRIPTION

2.1. LOCATION AND BRIEF DESCRIPTION

Mullagh historic landfill is located 1.5km from Mullagh village in the townland of Rantavan on local roadway (L-7114-0). The site encompasses an area of approximately 0.7 hectares. The land surrounding the site is predominately flat undulating in a south easterly direction. The site was used for grazing by local livestock but since the Tier 2 risk assessment the site has been fenced off and left fallow. The site is bordered by grassland on the northern and eastern boundary and forestry and scrubland on the southern and western boundary. Waste material protrudes through the capping layer and encroaches on the nearby watercourse. The site is secure and delineated by mesh wire fencing along the southern perimeter.

The main receptor is the watercourse on the northern and eastern aspect of the site which is immediate to the site boundary. The watercourse appears discoloured which may be attributed to the dumping ground. Dwelling houses were noted on the northern, north eastern and south eastern aspect which range from 160 – 340 m from the site boundary. The dwellings in the area are serviced by Mullagh Public Water Supply with the exception of one dwelling which is serviced by a private well (approximately 340 m from the site boundary).

The site boundaries are marked by a local road to the Southwest. The Northern, Eastern and Southern boundaries comprise of a wooden post and wire fence and watercourse. Land to the East and south is primarily open grass land of agricultural use while the land south of the site comprises of forestry and scrubland. The surrounding land use is predominantly agricultural and forestry.

2.2. SITE HISTORY

It is understood that waste disposal began at the site in 1972. A variety of wastes may have been deposited, including Municipal Solid Waste (MSW) and Construction and Demolition (C&D) wastes. It is alleged that the site was used for dumping industrial waste. The site employed the method of dump and burn which was common at dump sites in the 1970s -1980s, and was finally closed in 1989.

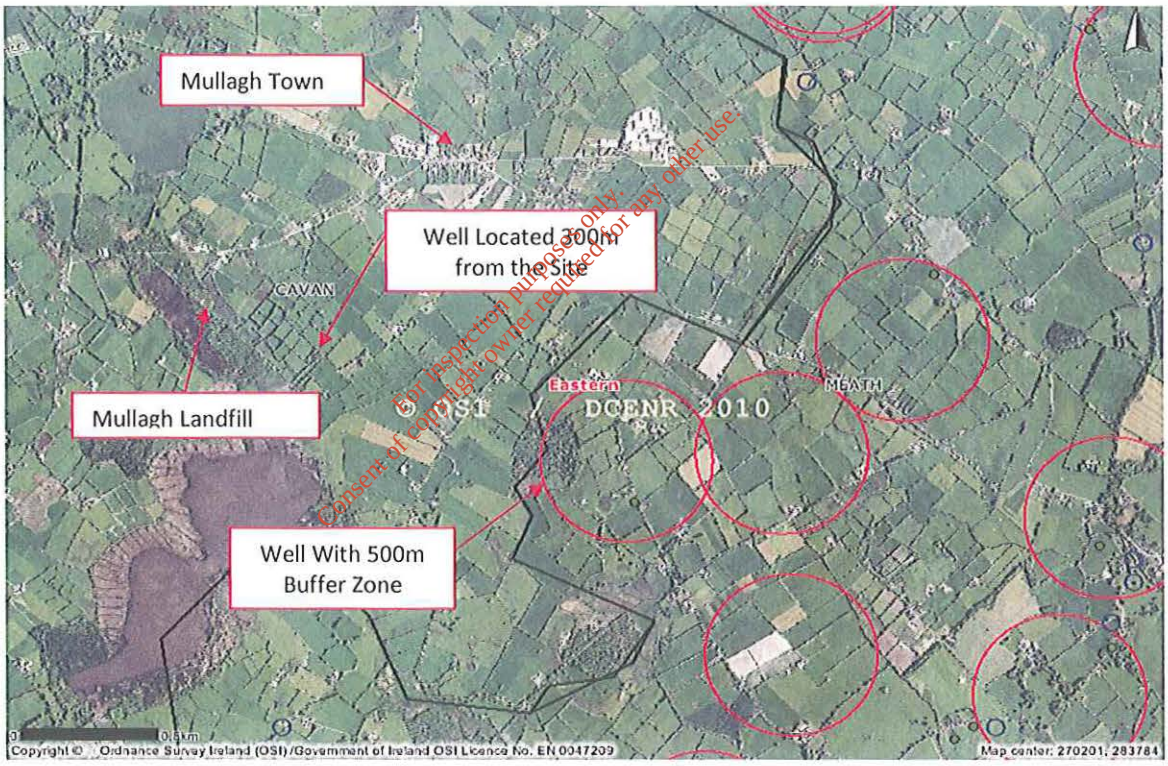
It is estimated that approximately 18,900 Tonnes of waste is deposited at the site. Following site investigations it was discovered that the waste encountered comprises of a large variety of materials including; Plastics, glass, concrete, steel, paper, tyres, wire, end of life vehicles (ELV's), vehicle parts, municipal waste, timber and trees. There was also evidence of a significant amount of potentially hazardous waste (e.g. oils). The nature of waste is typical of municipal waste that has been buried for over 20 years which has undergone considerable biodegradation. The lateral extent of the waste is shown in drawing No. 10-198-011, and covers an area of ca 8,589m^2.

3. 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 can be seen that the bedrock aquifer underlying the site has a classification of "Poor Aquifer" – Bedrock which is generally unproductive except for local zones.

Locations of wells in the vicinity of Mullagh Landfill.



Groundwater Vulnerability

The GSI vulnerability map (www.gsi.ie) indicates the vulnerability rating within the site is moderate and the area northeast of the site is high in terms of Vulnerability. The vulnerability mapping is based on the Vulnerability Classification Matrix, which assigns a vulnerability rating depending on the characteristics of the overburden deposits, the thickness of the strata and in 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 $R2^1$ response is recommended.

Table 1 - Response Matrix for Landfills

VULNERABILITY RATING	SOURCE PROTECTION AREA		RESOURCE PROTECTION Aquifer Category					
			Regionally Important (R)		Locally Important (L)		Poor Aquifer (P)	
	Inner (SI)	Outer (SO)	Rk	Rf/Rg	Lm/Lg	L1	Pl	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

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

There is a watercourse/drain immediately located on the North-eastern boundary. The surface water drainage features receive run-off from the fill area. The water level in the stream is approximately 3.0m below the site ground level. The nearest large body of water is Mullagh Lough located to the North West of the site. Based on the surface water quality data gathered during the Tier 2 investigation the historic landfill is not having a significant impact on the water quality downstream of the landfill site. The Q Values up-gradient and down-gradient are what would be assigned to poor quality water. The watercourse/drain running along the Northeastern boundary of the site is deemed to by seriously polluted. As mentioned above in Section 5.2 the peat layer is preventing the leachate entering the groundwater, but appears to be seeping into the watercourse/drain adjacent to the site. Given the age of the waste it is likely that the majority of mobile contaminants have long since leached into the watercourse/drain adjacent to the site. As mentioned in Section 5.1 SPR Linkage Number 8 has been proven thus risk ranking assigned accordingly i.e. **Moderate Risk.**

4.0 ECOLOGY OF SITE AND SURROUNDING AREA

The site of the old landfill lies approximately 0.8km North of Killyconny Bog SAC 000006. This is a raised bog habitat of approximately 191 hectares. The site comprises a core of uncut high bog occurring as two distinct lobes, joined by a narrow strip of bog

The main habitat on the site of the disused landfill is grassland (now disturbed). Habitats adjacent to the site include wet grassland, birch woodland and drains. A significant area of raised bog occurs on the opposite side of the road to the landfill. Overall, the areas surrounding the site are quite natural and have a moderately high level of biodiversity that is important on a local level. However, biodiversity within the footprint of the old landfill site is low.

Mullagh landfill is located within 10km of four Natura 2000 sites

1. Breakey Lough (NHA 001558)
2. Killyconny Bog (Cloughbally) (SAC & NHA 000006)
3. Lough Ramour (NHA 000008)
4. River Boyne & River Blackwater (SPA 004232) & (SAC 002299)

Details of the ecology on site and in the surrounding areas can be found in the full ecological assessment carried out by Noreen Mc Loughlin MSc. MIEEM on the 19th October 2010.(Appendix B Tier 2 Risk Assessment) Additional information can be found in Attachment E.1 – Appropriate Assessment of the Certificate of Authorisation Application Form.

5. POTENTIAL RISKS

5.1. RISK CATEGORY

The site has been categorized as a Class B (Moderate) risk site in accordance with the Code of Practice.

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

The watercourse/drain running down the Northeast boundary of the site is directly impacted by the historic landfill site. The ecological assessment close to the interaction zone (watercourse/drain and waste body) was classified as seriously polluted. The chemical analysis for the interaction zone proved negligible for contaminants with elevated levels of chromium above the environmental quality standard for surface waters noted. The lateral migration of contaminants to the watercourse/drain may be imminent due to variations in precipitation levels and thus varying discharges from the water body itself. The ecological assessment is deemed more reflective of the long term water quality and would confirm the Source-Pathway-Receptor linkage number 8.

The Q Values up-gradient and down-gradient are what would be assigned to poor quality water. The watercourse/drain running along the North-eastern boundary of the site is deemed to by seriously polluted. The peat layer is preventing the leachate entering the groundwater, but appears to be seeping into the watercourse/drain adjacent to the site. Given the age of the waste it is likely that the majority of mobile contaminants have long since leached into the watercourse/drain adjacent to the site. SPR Linkage Number 8 has been proven thus risk ranking assigned accordingly i.e. **Moderate Risk.**

5.2.2 Surface Water Contamination –Potential Environmental Impacts

The watercourse/drain could potentially be at risk during the excavation of the hazardous waste fraction from the waste body. The removal of the same could mobilize hazardous compounds which are currently bound within the waste/clay matrix of the landfill. The disturbance of the waste coupled with the shallow lateral groundwater flow could lead to the potential discharge to the watercourse/drain immediate to the site. Furthermore, the cleaning of the watercourse/drain could contain immobile contaminants bound within the sediment layer at the base of the watercourse/drain. The disturbance of this sediment layer could re-activate dormant contaminants and impact negatively on the watercourse/drain.

5.2.3 *Groundwater Contamination – Actual Environmental Impacts*

Based on the groundwater quality data gathered during the risk assessments, the historic landfill is not having a significant impact on the groundwater quality down-gradient of the historic landfill site. This assessment is based on results of groundwater monitoring carried out on the trial hole (TH21 – Baseline Data Source) located down-gradient of the historic landfill site. The waste is underlain by a layer of peat which appears to be retarding the downward movement of any leachate resulting in preferential flow to the surface water system

5.2.4 *Groundwater Contamination – Potential Environmental Impacts*

The shallow lateral groundwater flow is currently interacting with the waste and hazardous waste fraction within the waste body. The removal of the hazardous waste by excavator could potentially puncture the peat and heavy impermeable clay layer (barrier layer) and lead to the vertical movement of contaminants to groundwater

5.2.5 *Landfill Gas Migration - Actual Environmental Impacts*

8 No. trial holes were monitored for landfill gas. After monitoring the 8 No. trial holes it was decided to cease gas monitoring due to the low levels of gas detected in the first 8 trial holes. The gas monitoring programme included the measurement of methane and carbon dioxide. The meter was calibrated before use. Based on the negligible landfill gas levels detected Traynor Environmental Ltd considers that the risk posed by landfill gas to be insignificant and no mitigation measures are needed.

5.2.6 *Landfill Gas Migration - Potential Environmental Impacts*

Dump and burn was used extensively at this landfill site. This would have resulted in the immediate destruction of the organic waste fraction within the waste body and subsequently limited the generation of landfill gas. There is no potential risk to nearby receptor from the migration of landfill gas

5.2.7 *Human Beings - Actual Environmental Impacts*

Currently the waste including the hazardous waste fraction is bound within the landfill and covered with a thin cap layer. The material is stable, immobile and in a rural location away from built up areas. Dwelling houses vary in distance from the landfill site which range from 160m to 340m respectively.

5.2.8 *Human Beings - Potential Environmental Impacts*

The removal of the hazardous waste could pose a potential risk to residents living in the area. The prevailing wind direction over Ireland is mainly South Westerly. Dwelling houses located on the North Eastern aspect of the site could be affected by the remediation works. Fine airborne particles with a potentially hazardous component could be mobilised from the remediation works thus impacting on nearby residents.

6. PROPOSED REMEDIATION WORKS – OPTION A

6.1 GENERAL

The waste on site is covered by a thin layer of topsoil, which in some areas of the site is underlain by a layer of clay fill which ranged in thickness from 0.2m (TH16) to 1.0m (TH 10). The average thickness of this layer is 0.54m. This Clay layer was underlain by waste material which ranged in thickness from 0.4m (TH9) to 2.2m (TH9). The waste is thickest in the centre of the site, with an average thickness across the site of 1.25m. The base of the waste is defined by a layer of peat, which marks the top of the underlying natural subsoil's.

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

- Removal of Hazardous Wastes;
- Remediation/Removal of Contaminated Soil;
- Remediation/Removal of Contaminated Ground water;
- Remediation/Removal of Contaminated soil from base of adjacent watercourse/drain.
- Chemical and Biological Monitoring
- Capping of Mullagh Landfill
- Surface water Control and Management

6.2 SUMMARY OF MEASURES

6.2.1 Removal of Hazardous Wastes

A total of 21 trial holes were excavated on site with 18 excavated within the landfill footprint itself. Another 3 trial holes were excavated outside of the main landfill body for the purpose of providing baseline assessment and data. Hazardous waste was identified in trial holes 3, 6, 8, 11, 13 and 18 during investigation works. A full listing of parameters sampled and associated results can be found in Appendix C of the Tier 2 Environmental Risk Assessment – Alcontrol Laboratories Certificate of Analysis. From the analysis of sample results obtained, the waste/clay mixture in areas around trial holes 3, 6, 8, 11, 13 and 18 have been deemed hazardous.

Alternative Considered

The waste around trial holes 3, 6, 8, 11, 13 and 18 has been deemed hazardous. Sample results for groundwater and soil coupled with on site observations confirm the presence of hazardous waste. Leaving the waste in-situ and monitoring was not considered a feasible option given the contaminants identified in the Tier 2 Environmental Risk Assessment. (Note: - Dutch Intervention Values were exceeded in the aforementioned trial holes).

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd recommends the complete dig-out and removal of all hazardous waste in and around trial holes 3, 6, 8, 11, 13 and 18 on site. The guesstimated tonnage for dig-out and removal is 3,360.

Timescale for Completion of Works

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would guesstimate a timeframe of 2-3 months for the dig-out and removal of hazardous waste in and around the aforementioned trial holes. The said timescale for the removal of the hazardous waste is dependent on resources available, weather conditions and no unforeseen problems during the excavation works e.g. greater quantities of hazardous waste than first estimated.

6.2.2 Remediation/Removal of Contaminated Soil

Soil samples were taken during the Tier 2 Environmental Risk Assessment and analysed as per the EPA Landfill monitoring requirements. Soil samples taken from trial holes 11, 13 and 18 were deemed hazardous with Dutch Reference and Intervention values exceeded for the said trial holes

The following parameters exceeded the Dutch Reference and Intervention values for the aforesaid trial holes:-

- Copper
- Lead
- Nickel
- Zinc
- PAH Total US EPA 16

Alternative Considered

- Soil can be excavated from the ground and be either treated or disposed
- Soil can be left in the ground and treated in-situ
- Soil can be left in the ground and contained to prevent the contamination from mobilising and interacting with uncontaminated areas of the site

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd recommends the complete dig-out and removal of contaminated soil around trial holes 3, 6, 8, 11, 13 and 18. The guesstimated tonnage for dig-out and removal would be similar to the hazardous waste tonnage above.

Timescale for Completion of Works

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would guesstimate a timeframe of 2-3 months for the dig-out and removal of contaminated soil in and around the aforementioned trial holes. The said timescale for the removal of the contaminated soil is dependent on resources available, weather conditions and no unforeseen problems during the excavation works e.g. greater quantities of contaminated soil than first estimated.

6.2.3 Remediation/Removal of Contaminated Ground water

Groundwater samples taken during the excavation of the trial pits were analysed as per the EPA Landfill monitoring requirements. Groundwater samples taken from trial holes 3, 6, 8, 11, 13 and 18 were deemed hazardous with exceedances for the following parameters:-

- Mineral oil >C10 C40 (aq)
- EPH Range >C10 - C40 (aq)
- Fluoranthene (aq)
- Anthracene (aq)
- Chrysene (aq)
- Benzo(a)anthracene (aq)
- Benzo(b)fluoranthene (aq)
- Benzo(a)pyrene (aq)
- Benzo(g,h,i)perylene (aq)
- Indeno(1,2,3-cd)pyrene (aq)

Alternative Considered

- Groundwater which is deemed to be hazardous in terms of chemical and oil contamination could be removed by vacuum tanker and sent for disposal using a hazardous waste contractor.
- Groundwater which is deemed to have only oil contamination could be removed by vacuum tanker and passed through a full oil retention separator with the resultant oil sent for hazardous waste disposal. The water arising from the separator could be discharged to the watercourse/drain providing a full schedule of testing is carried out prior to discharge.
- Contaminated groundwater could be left in the ground and contained to prevent leaching and the mobilisation of contaminates.

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd recommends the pump-out and disposal of contaminated groundwater. Groundwater samples taken during the excavation of the trial pits were analysed as per the EPA Landfill monitoring requirements. Groundwater samples taken from trial holes 3, 6, 8, 11, 13 and 18 were deemed hazardous with exceedances for the following parameters:-

- Mineral oil >C10 C40 (aq)
- EPH Range >C10 - C40 (aq)
- Fluoranthene (aq)
- Anthracene (aq)
- Chrysene (aq)
- Benzo(a)anthracene (aq)
- Benzo(b)fluoranthene (aq)
- Benzo(a)pyrene (aq)
- Benzo(g,h,i)perylene (aq)
- Indeno(1,2,3-cd)pyrene (aq)

Timescale for Completion of Works

The removal and disposal of the hazardous waste and soil is guesstimated at 2-3 months and the pump-out phase will probably mirror this timescale. The timescale would also be dependent on resources available, weather conditions and no unforeseen problems during the pump-out phase e.g. greater volumes of contaminated pump-out water than first anticipated.

6.2.4 Remediation/Removal of Contaminated soil from base of adjacent watercourse/drain

A large amount of contaminants are possibly bound within the substrate at the base of the watercourse/drain that is immediate to the landfill. Chemical analysis of the surface water indicated elevated levels of Manganese and Chromium only. However, the biological analysis indicated long term pollution effects on the watercourse from the waste body and this was validated by the Q2 biological assessment rating assigned along the interaction zone. Contaminants within the substrate could be mobilised intermittently with rainfall events or disturbance of the substrate and thus impact negatively on water quality.

Alternative Considered

- Watercourse/drain could be cleaned and disposed of accordingly
- Watercourse/drain could be left undisturbed and contained to prevent the mobilisation of possible contaminants
- New surface water drain could be constructed in close proximity to the existing watercourse/drain and the watercourse/drain could be left undisturbed.

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd recommends the removal of the substrate at the base of the watercourse and the disposal of same with a hazardous waste disposal company.

Timescale for Completion of Works

The guesstimated timescale for the removal of the substrate and the re-engineering of the watercourse is 2-4 weeks. The aforesaid timescale would be dependent on resources available, weather conditions and no unforeseen problems during the re-engineering works.

6.2.5 Chemical and Biological Monitoring

Prior to and during the course of the remediation works chemical monitoring will be carried out periodically on both surface and groundwater within the vicinity of the landfill. Surface water samples will be taken upstream, downstream and from the interaction zone of the watercourse/drain. Groundwater samples will be taken from boreholes installed up gradient and down gradient of the landfill. It is proposed to install 3 boreholes outside the waste body with one located up gradient of the site (GW1) and two located down gradient of the site (GW2 & GW3).

6.2.6 Capping of Mullagh 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 what ever combination of remediation options are carried out.

Capping

Capping of the landfill with a suitable capping layer will result in a significant reduction in the amount of leachate generated within the site 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 Mullagh 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.

6.2.7 Surface water Control and Management

The capping and regarding of the landfill will reduce the infiltration of precipitation into the waste body and promote surface water run-off and drainage to the watercourse/drain on the North-eastern aspect of the landfill. This will prevent the interaction of clean precipitation with the waste body, minimise the generation of leachate and limit the recharge of shallow groundwater flow.

7.0 PROPOSED REMEDIATION WORKS – OPTION B

7.1 GENERAL

The main waste type dumped at Mullagh Historic Landfill was believed to be municipal waste. However, following extensive investigations of the site it was established that parts of the site contained hazardous waste. Trial holes 3, 6, 8, 11, 13 and 18 had parameters which exceeded the Dutch Intervention Values and would be deemed hazardous waste hotspots within the site. The proposed remediation 'Option B' considers leaving the waste in-stu and the undertaking of measures associated with this.

The proposed measures being considered for the historic landfill under option B are as follows:

- Installation of an interceptor drain upslope of the historic landfill.
- Re-engineering of existing watercourse/drain.
- Capping of Mullagh Landfill.
- Chemical and Biological Monitoring.

7.2 SUMMARY OF MEASURES

7.2.1 Installation of Interceptor Drain

Shallow lateral groundwater flow is the predominant pathway through the waste body with basal discharges to the watercourse/drain immediate to the site. This groundwater flow is actively interacting with the waste body/hazardous waste and leading to the contamination of shallow groundwater as proven by the chemical analysis carried out in the Tier 2 Risk Assessment (refer to Tier 2 Risk Assessment Report). The main aim of the interceptor drain upslope of the historic landfill is to disrupt the shallow groundwater flow dynamics within the site. The installation of the interceptor drain will break the movement of shallow groundwater into the site and ultimately lower the water table within the waste body. The volume of groundwater entering and interacting with the waste body would be reduced thus minimising the contamination of groundwater and subsequent basal discharges from the site.

Alternative Considered

The installation of sheet piling along the north eastern aspect of the landfill was considered as an alternative to an interceptor drain. The sheet piling would act as a barrier to the movement of shallow groundwater flow minimising the interaction of groundwater with the waste body. However, the use of sheet piling would not guarantee the complete isolation of groundwater from the waste body. Furthermore, sheet pilling could lead to the puncture of the peat layer thus enabling the vertical migration of contaminates.

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd would recommend the installation of the interceptor drain upslope of the landfill, but the said works could not be carried out in isolation. The groundwater within the waste body would require removal and disposal by vacuum tanker. This would prevent the reversal of the groundwater dynamics and the release of contaminates thus minimising the impact on the receptors immediate to the site.

Timescale for Completion of Works

The guesstimated timescale for the installation of the interceptor drain would be 2-3 weeks. The aforesaid timescale would be dependent on resources available, weather conditions and no unforeseen problems during the engineering works.

7.2.2 Re-engineering of Existing Watercourse/Drain

The watercourse/drain immediate to the site is actively interacting with the waste body and impacting negatively on surface water quality. The biological analysis indicated long term pollution effects on the watercourse/drain from the waste body and this was validated by the Q2 biological assessment rating assigned along the interaction zone. The re-engineering of the existing watercourse/drain would prevent the interaction of surface water with the waste body. The re-engineering works would create a physical barrier between the waste body and watercourse/drain disrupting the pathway for contaminants and isolating the receptor.

Alternative Considered

- Watercourse/drain could be left undisturbed to prevent the mobilisation of possible contaminants.
- New surface water drain could be constructed in close proximity to the existing watercourse/drain and the watercourse/drain could be left undisturbed.

Recommended Remediation Measure

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental would recommend the re-engineering of the existing watercourse with the aim of isolating the watercourse/drain from the waste body. This may be achieved by the installation of an impermeable liner between the waste body and watercourse/drain or the piping of the watercourse/drain.

Timescale for Completion of Works

The guesstimated timescale for the re-engineering of the watercourse/drain would be 2-4 weeks. The aforesaid timescale would be dependent on resources available, weather conditions and no unforeseen problems during the re-engineering works.

7.2.3 Capping of Mullagh 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 remediation options are carried out.

Capping

Capping of the landfill with a suitable capping layer will result in a significant reduction in the amount of leachate generated within the site 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 Mullagh 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.

7.2.4 Chemical and Biological Monitoring

Prior to and during the course of the remediation works chemical monitoring will be carried out periodically on both surface and groundwater within the vicinity of the landfill. Surface water samples will be taken upstream, downstream and from the interaction zone of the watercourse/drain. Groundwater samples will be taken from boreholes installed up gradient and down gradient of the landfill. It is proposed to install 3 boreholes outside the waste body with one located up gradient of the site (GW1) and two located down gradient of the site (GW2 & GW3).

8.0 CONCLUSION AND RECOMMENDATIONS

8.1 CONCLUSION

The Tier 2 Exploratory and intrusive investigations identified that there is hazardous waste contamination within the historic landfill located at Rantavan, Mullagh, Co. Cavan around trial holes 3, 6, 8, 11, 13 and 18.

The Q Values up-gradient and down-gradient of the historic landfill are what would be assigned to poor quality water. The watercourse/drain running along the North-eastern boundary of the site is deemed to by seriously polluted. The presence of a peat layer is preventing the leachate entering the groundwater, but appears to be seeping into the watercourse/drain adjacent to the site. Given the age of the waste it is likely that the majority of mobile contaminants have long since leached into the watercourse/drain adjacent to the site.

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 moderate and high to the East of the site. The landfill response is assigned a R2[1].

Based on the groundwater quality data gathered during the Tier 2 investigation the historic landfill is not having a significant impact on the groundwater quality down-gradient of the historic landfill site. This assessment is based on results of groundwater monitoring carried out on the trial hole (TH21 – Baseline Data Source) located down-gradient of the historic landfill site. The waste is underlain by a layer of peat which appears to be retarding the downward movement of any leachate resulting in preferential flow to the surface water system.

8 No. trial holes were monitored for landfill gas. After monitoring the 8 No. trial holes it was decided to cease gas monitoring due to the low levels of gas detected in the first 8 trial holes. Based on the negligible landfill gas levels detected Traynor Environmental Ltd considers that the risk posed by landfill gas to be insignificant and no mitigation measures are needed.

The Tier 2 Risk Assessment process has resulted in the risk rating for the historic landfill remaining as **Moderate Risk.** SPR Linkage number 8 has been proven and thus risk rating assigned accordingly as **Moderate**. SPR2 has changed from a linkage score of 0.00 in the Tier 1 to 8.33; SPR4 has also changed from a linkage score of 0.00 to 6.25; and SPR9 has changed from a linkage score of 0.00 in the Tier 1 to 16.67. The change in the linkage scores did not change the overall risk rating of the site which remains as **Moderate Risk.**

8.2 RECOMMENDATIONS

The Waste Management Section of Cavan County Council in conjunction with Traynor Environmental Ltd recommends **Option A** for the remediation of Mullagh Historic Landfill. The proposed remediation measures outlined in Option A will eliminate the source of contamination, disrupt the contamination pathways and isolate the receptor (watercourse/drain) from the waste body. SPR Linkage No. 8 would be broken and the required environmental outcome would be achieved.

The application of remediation measures outlined in Option B would not significantly change the SPR Linkage. The complete isolation of shallow lateral groundwater flow from the waste body and hazardous waste cannot be guaranteed by the interceptor drain. Furthermore, the re-engineering of the watercourse/drain may place a physical barrier between the receptor and the waste body. However, intermittent basal discharges will still continue due to the infiltration of precipitation into the waste body.

Subject to appropriate remediation measures as outlined in **Option A** of the Tier 3 been adhered to the risk rating for Mullagh historic landfill would be reduced from a Moderate Risk to a Low Risk site as a number of SPR linkages would have changed:

- SPR1 would change from a linkage score of 25.00 to 15.0;
- SPR2 would change from a linkage score of 8.33 to 5.00;
- SPR8 WOULD CHANGE FROM A LINKAGE SCORE OF 50.00 TO 0.00;
- SPR9 would change from a linkage score of 16.67 to 0.00;

The change in the linkage scores after remediation works would change the overall risk rating of the site which is currently moderate risk to low risk.

8.3 SPR LINKAGES AFTER REMEDIATION WORKS CARRIED OUT

Table 2: 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 x (2a + 2b + 2c) x 3e**	**45**	**300**	**Leachate → Surface Water**	**15**
***SPR 2 = 1a x (2a + 2b + 2c) x 3b**	**15**	**300**	**Leachate → SWDTE**	**5**
SPR 3 = 1a x (2a + 2b) x 3a	30	240	Leachate → human Presence	12.5
SPR 4 = 1a x (2a + 2b) x 3b	15	240	Leachate → GWDTE	6.25
SPR 5 = 1a x (2a + 2b) x 3c	15	400	Leachate → Aquifer	3.75
SPR 6 = 1a x (2a + 2b) x 3d	0	560	Leachate → Surface Water	0.00
SPR 7 = 1a x (2a + 2b) x 3e	45	240	Leachate → SWDTE	18.75
***SPR 8 = 1a x 2c x 3e**	**0**	**60**	**Leachate → Surface Water**	**0.00**
***SPR 9 = 1a x 2c x 3b**	**0**	**60**	**Leachate → SWDTE**	**0.00**
SPR 10 = 1b x 2d x 3f	7.5	150	Landfill Gas → Human Presence	5.00
SPR 11 = 1b x 2e x 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	Low Risk (Class C)