Padraic Mulroy

From: Padraic Mulroy <ptmulroy@mulroyenvironmental.ie>
Sent: Friday 28 October 2022 10:29
To: cryder@galwaycoco.ie
Cc: fconnolly@mulroyenvironmental.ie
Subject: Mulroy Environmental Ltd. - Galway C.C. - Tullyvogheen`` Historic Landfill - Surface Water Monitoring Report on the 30th August 2022

Colin,

As per our Fee Proposal PRP500.03.03.2022 of the 3rd March, 2022, please find attached a factual report for the round of surface water monitoring which was carried out on the 30th August 2022. This report consists of the following:

- Table 1. Results of Inorganic and Microbiological Laboratory Analyses on Surface Water Samples (SW1-SW7) taken from Surface Water Bodies at Tullyvogheen Historic Landfill, Clifden, Co. Galway (30.08.22);

- *Appendix 1 – 6 x Tables of SW Monitoring Results & Surface Water Field Monitoring Logs*

    - Table A1.1. Results of Volatile Organic Compound laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Tullyvogheen, Clifden, County Galway on 30th August 2022;
    - Table A1.2. Results of Semi-volatile Organic Compound laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Tullyvogheen, Clifden, County Galway on 30th August 2022;
    - Table A1.3. Results of Organochlorine Pesticides laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Clifden, Co. Galway on 30th August 2022;
    - Table A1.4. Results of Organo-phosphorus and Organo-Nitrogen Pesticide laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Tullyvogheen, Clifden on 30th August 2022;
    - Table A1.5. Results of Field Multiprobe Readings on Surface Water Samples taken from Locations SW1 to SW7 on stream adjacent to Tullyvogheen Historic Landfill and on the Owenglen River on the 30th August, 2022; and
    - Table A1.6. Major Ion Balance on Surface Water Samples (SW1-SW7) taken at Surface Water Bodies at Tullyvogheen Historic Landfill, Clifden (30th August 2022).

- *Appendix 2 – Raw Validated Laboratory Data for Eurofins Chemtest Ltd. & CLS Laboratory Rosmuc*

- *Appendix 3 – Surface Water Monitoring Logs*

The results can be summarised as:

Ammonia
For landfills, ammonia is the key contaminant of concern and as such, we would state the following:

- As can be seen from Table 1, there are exceedances of the ammonia threshold limit of 0.07ug/l in 2 of the downgradient monitoring points, SW2 and SW3. Ammonia was also detected in the upgradient monitoring point, SW1 at 0.058ug/l and in the downgradient monitoring point, SW5 at 0.025ug/l. Ammonia was not detected in in the downgradient monitoring points SW4 and SW7.
- *SW1* - The result for SW1 indicates that the surface water entering the site has been impacted upgradient of the site most likely from the Coillte forestry and/or agricultural run-off/animal faeces. The level of ammonia in the

upgradient point, SW1 decreased from 0.117ug/l in 2021 to 0.058ug/l in 2022 (please note that ammonia levels in SW1 in 2020 were 0.032ug/l);

- *SW2 & SW3* - The highest level of ammonia is at 1.79ug/l at SW2 which is immediately downgradient of the culvert discharge. The levels of ammonia then decrease to 0.76ug/l at the downgradient points SW3. The levels of ammonia found at SW2 and SW3 are most likely emanating from perched groundwater which has arisen in the wetland and waterlogged area immediately upgradient of the culvert (i.e. to the west of the landfill). This area is saturated with iron oxide (i.e. note previous correspondence regarding a land drain excavated in this area which released fines into the stream). The ammonia levels are being diluted as the stream progresses southwards towards the Owenglen River. It is important to note that other contributory streams (such as the stream from Nambrickagh Lough) are diluting the ammonia in the stream as it approaches the Owenglen River. SW3 is downgradient of the confluence of the stream with the stream from the Nambrickagh which is significantly diluting the ammonia;
- *SW4* – Ammonia was not identified in the stream which is downgradient of the sheep farm complex to the southwest and downgradient of the landfill. This is most likely down to significant dilution by the Nambrickagh and other smaller streams joining the stream from the northwest;
- *SW5* - Ammonia was found at SW5 at 0.025ug/l which was below the threshold level. The ammonia in the vicinity of SW5 is most likely arising from other external suspected sources;
- *SW6 & SW7* - Ammonia was not detected in the Owenglen River in the upgradient or downgradient locations. This is to be expected, given that ammonia levels at SW4, which is approximately 440m upgradient of the stream's confluence with the Owenglen River, have already been reduced to background levels.

Heavy Metals
With regard to heavy metals, the only exceedances are as follows:

- *Iron & Manganese* - Levels of iron exceed the Parametric Value at all 7 locations and are highest at SW2 immediately downgradient of the discharge point and decrease at each point until the stream joins the Owenglen River. Manganese exceeded its parametric value at SW1, SW2 and SW3 but is diluted to below the parametric value from SW4 and downgradient;

- *Zinc* - Zinc levels exceeded the Threshold Value of 10ug/l at 1 location, SW2 immediately downgradient of the discharge.

It is important to note that the upgradient levels of selenium were higher than the downgradient levels. As such, there is no evidence that the landfill is effecting selenium levels in the surface water body downgradient of the landfill. Unlike in 2021, antimony, chromium, mercury and selenium have not been detected above their respective parametric values and/or Threshold Values.

It was stated in our 2021 report that it is likely that the antimony, chromium, mercury and selenium levels found in the surface water body in 2021 are naturally occurring geochemical levels that occur within this region of Ireland. Given that these metals were found in 2021 at similar or higher levels upgradient of the landfill would still reinforce this argument. Their significant decrease in 2022 may indicate that less soil erosion is occurring upgradient of the site due to the decrease in sheep grazing numbers in the area (i.e. overgrazing of upland pasture was known to cause increase erosion of upland peats and run-off of fines). There was a notable decrease in the level of tannins found in the surface water samples taken in 2022.

Oxygen Demand
Given that the BOD at all locations and particularly downgradient of the landfill was at background levels, this would indicate that there are very low levels of available carbon sources within the landfill which is consistent with the age of the waste. As such, the capacity of the landfill to impact on the surface water body through the breaking down of leachable carbon sources and the consumption of oxygen by bacteria through respiration is negligible. This is reinforced by the high levels of dissolved oxygen in the surface water body. The highest BOD level was found at the upgradient point, SW1 (i.e. 2mg/l). It should be noted however, that the Limit of Detection for BOD is <1mg/l.

The highest level of Chemical Oxygen Demand was at the downgradient location SW4. This exceeded the 1989 MAC for Drinking Water. All other levels are below the MAC of 40mg/l. These results indicate that there are very low levels of non-biological (i.e. carbon source) and oxidisable components within the surface water stream.

Microbiology
SW1 - The results of the bacterial analyses on the surface water indicate that the surface water catchment is affected by horizontal run-off of agricultural animal faeces and/or Coillte forestry practices upgradient of the site. However, this run-off most likely has decreased in the last year due to the decrease in sheep grazing numbers in the area;

SW2, SW3 & SW4 - It should be noted that no Faecal Coliforms (i.e. Thermotolerant *E. coli)* were found at SW2 but higher levels were identified at SW3 which is downgradient of the confluence with the Nambrickagh Lake stream. The increased levels found at SW4 suggest possible agricultural impact;

SW5 - The highest levels of coliforms were identified at SW5 strongly suggesting an impact from external inputs in the vicinity and upgradient of SW5;

SW6 & SW7 - The levels of Coliforms found on the Owenglen River upgradient and downgradient of the confluence with the subject stream were signicantly lower than the levels found at SW5 indicating that the source of contamination is most likely being diluted in the Owenglen. There is a negligible difference in the levels of coliforms found between SW6 and SW7.

Trace Organics
There was no evidence of trace levels of VOCs, sVOCs or organo-chlorine, organo-phosphorus or organo-nitrogen pesticides in the surface water body system surrounding the site.

Overall Conclusions
Although there was an iron precipitate observed in the sediment at the 2 downgradient sampling locations, SW2 and SW3, the results indicate that the landfill is continuing to undergo intrinsic remediation. Given that the BOD at all locations and particularly downgradient of the landfill was at background levels, this would indicate that there are very low levels of available carbon sources within the landfill which is consistent with the age of the waste. These levels are also reflected in the low levels of Chemical Oxygen Demand observed in all monitoring locations along the stream. The decrease in the concentration of heavy metals in the surface water (i.e. antimony, chromium, mercury and selenium levels) since 2021 is notable. Although the highest levels of iron and manganese were found in SW1, SW2 and SW3, these levels decrease incrementally as the stream approaches the confluence with the Owenglen River. The ammonia levels observed at SW2 and SW3 are very much localised and are significantly diluted by the Nambrickagh Lough stream and other streams with the effect that no ammonia was observed at SW4. The microbiological results do not indicate any effect on bacterial counts by the landfill on the stream. The highest levels of coliforms were identified at SW5 strongly suggesting an impact from external inputs in the vicinity and upgradient of SW5.

It is expected that the landfill continues to undergo intrinsic remediation and that the afore-mentioned trends in chemical and biological parameters will continue over the coming years.

Please call if you have any questions with regarding the above.

Yours sincerely,

Padraic Mulroy

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GALWAY COUNTY COUNCIL

TULLYVOGHEEN HISTORIC LANDFILL,

CLIFDEN, COUNTY GALWAY

SURFACE WATER MONITORING,

30TH AUGUST 2022

12th October 2022

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Table 1. Results of Inorganic and Microbiological Laboratory Analyses on Surface Water Samples (SW1-SW7) taken from Surface Water Bodies at Tullyvogheen Historic Landfill, Clifden, Co. Galway (30.08.22)

Parameter	Units	Statutory Limits					Off-Site Surface Water						
		S.I. No. 294, European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989	*S.I. No. 278, European Communities Environmental Objectives (Drinking Water) (No. 2) Regulations, 2007*	*S.I. No. 272, EC Environmental Objectives (Surface Water) Regulations, 2009)*	*S.I 386 EC Environmental Objectives (Surface Waters) Regulations 2015 (Lowest Threshold Values Taken)*	*S.I 77 EC Environmental Objectives (Surface Waters) Regulations 2019 (Lowest Threshold Values Taken)*	SW1 (Upgradient)	SW2 (Downgradient)	SW3 (Downgradient)	SW4 (Downgradient)	SW5 (Downgradient)	SW6 (Downgradient)	SW7 (Downgradient)
		MACs 1.	*Parametric Values*	*Threshold Values (AA-EQS)* 2.	*Threshold Values (MAC-EQS)* 3.	*Threshold Values* 4.							
Physico-Chemical Parameters													
pH		5.5 - 8.5	-	6..0<pH<9..0	-	-	8.0	8.1	7.9	7.8	7.8	7.9	7.8
Electrical Conductivity	µS/cm	1,000.00	2,500.00	-	-	-	320	250	240	230	240	120	120
Redox Potential	mV	-	-	-	-	-	54	66	70	76	84	91	95
Dissolved oxygen (DO)	mg/l	-	-	-	-	-	6.3	6.4	6.7	6.5	6.2	6.4	6.9
Standard Chemistry													
Total Suspended Solids (TSS)	mg/l	50	-	-	-	-	< 5.0	10	< 5.0	10	< 5.0	< 5.0	< 5.0
Total alkalinity	mg/l	-	-	-	-	-	26	100	43	50	54	21	22
Total Hardness (as CaCO3)	mg/l	-	-	-	-	-	37	93	57	56	59	24	28
Ammonia (as NH_3)	mg/l	-	-	0.07	-	-	0.058	**1.79**	**0.763**	<0.005	0.025	<0.005	<0.005
Ammonium as NH4	mg/l	0.20	0.30	-	-	-	0.075	**2.31**	**0.984**	<0.01	0.032	<0.01	<0.01
Nitrate NO_3	mg/l	50	50	-	-	-	< 0.50	0.87	0.84	4.30	3.40	< 0.50	< 0.50
Nitrite NO_2	mg/l	-	0.50	-	-	-	< 0.020	0.027	0.12	< 0.020	< 0.020	< 0.020	< 0.020
Chloride Cl^-	mg/l	250	250	-	-	-	43	53	42	41	40	19	21
Sulphate SO_4	mg/l	200	250	-	-	-	< 1.0	< 1.0	4.10	1.70	5.30	3.10	4.00
Sulphide S^{2-}	mg/l	-	-	-	-	-	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Major Cations													
Potassium (K)	mg/l	-	-	-	-	-	0.61	2.00	1.20	1.30	1.30	0.57	0.64
Sodium (Na)	mg/l	-	*200.00*	-	-	-	28	40	33	30	29	13	15
K/Na Ratio							1/46.1	1/20.5	1/27.0	1/23.8	1/23.6	1/22.8	1/22.9
Calcium (Ca)	mg/l	-	-	-	-	-	7.90	28.00	16.00	15.00	16.00	5.50	6.60
Magnesium (Mg)	mg/l	-	-	-	-	-	4.30	5.90	4.30	4.30	4.60	2.60	2.80
Heavy Metals													
Antimony (Sb)	µg/l	-	5	-	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Arsenic (As)	µg/l	50	10	25	-	-	0.50	0.46	0.44	0.27	0.29	0.35	0.23
Boron (B)	µg/l	2,000	1,000	-	-	-	30	71	45	60	63	32	28
Cadmium (Cd)	µg/l	5	5	0.08	-	-	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
Chromium	µg/l	50	-	3.4	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Copper (Cu)	µg/l	50	2,000	5	-	-	3.1	0.55	2.5	0.64	0.61	< 0.50	0.73
Iron (Fe)	µg/l	200	200	-	-	-	**620**	**3,100**	**800**	**410**	**430**	**290**	**250**
Lead (Pb)	µg/l	50	10	7.2	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Ni)	µg/l	-	20	20	-	-	< 0.50	< 0.50	0.60	0.50	< 0.50	< 0.50	< 0.50
Manganese (Mn)	µg/l	50	50	-	-	-	**270**	**390**	**240**	12	21	7.6	5.6
Mercury (Hg)	µg/l	1	1	-	0.07	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Selenium (Se)	µg/l	10	10	-	-	-	1.00	0.63	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Zinc (Zn)	µg/l	3,000	-	50	-	-	14	**110**	11	9.5	8.0	7.6	5.0

Note:

Cadmium - Results of Total Hardness Analysis on 7 surface water samples range from 28ug/l to 93ug/l with 3 of the 7 results <40mg/l. Therefore, a Water Hardness Class I has been selected and as such, a cadmium AA-EQS of 0.08ug/l has been selected (i.e. worse case scenario)

Copper - Results of Total Hardness Analysis on 7 surface water samples range from 28ug/l to 93ug/l and are all <100mg/l. Therefore, a copper AA-EQS of 5ug/l has been selected.

Zinc - Results of Total Hardness Analysis on 7 surface water samples range from 28ug/l to 93ug/l and are all greater than 10mg/l and less than 100mg/l. Therefore, a zinc AA-EQS of 50ug/l has been selected.

450.00	Values are shaded yellow and in RED bold where S.I. No. 272 Surface Water Reg. Threshold Levels are exceeded
450.00	Values are in RED bold where SI No. 294 of 1989 MACs, SI No. 278 of 2007 Parametric Values are exceeded

< = Less than

'-' signifies analysis not carried out on sample or no SI No.293 of 1988 WQS, SI No. 294 of 1989 MACs, SI No. 278 of 2007 Parametric Values, or S.I. No. 272 2007 Surface Water Reg., S.I. No. 386 2015 Surface Water Reg. or S.I. No. 77 2019 Surface Water Reg.Threshold Levels are available.

1. Thresholds have been determined based on A1 Category surface waters as defined by S.I. No. 294 of 1989 MACs. Where limits for A1 Category are not defined A2 or A3 limts have been applied

2. Nutrient thresholds have been determined based on Good Status (mean) limits. Specific pollutants have been determined based on MAC - EQS for inland surface waters. Ammonia Threshold Value refers to Total Ammonia (mg N/l) mean value

Table 1. Results of Inorganic and Microbiological Laboratory Analyses on Surface Water Samples (SW1-SW7) taken from Surface Water Bodies at Tullyvogheen Historic Landfill, Clifden, Co. Galway (30.08.22) (continued)

Parameter	Units	Statutory Limits					Off-Site Surface Water						
		S.I. No. 294, European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989	*S.I. No. 278, European Communities Environmental Objectives (Drinking Water) (No. 2) Regulations, 2007*	*S.I. No. 272, EC Environmental Objectives (Surface Water) Regulations, 2009)*	*S.I 386 EC Environmental Objectives (Surface Waters) Regulations 2015 (Lowest Threshold Values Taken)*	*S.I 77 EC Environmental Objectives (Surface Waters) Regulations 2019 (Lowest Threshold Values Taken)*	SW1 (Upgradient)	SW2 (Downgradient)	SW3 (Downgradient)	SW4 (Downgradient)	SW5 (Downgradient)	SW6 (Downgradient)	SW7 (Downgradient)
		MACs 1.	*Parametric Values*	*Threshold Values (AA-EQS)* 2.	*Threshold Values (MAC-EQS)* 3.	*Threshold Values* 4.							
Oxygen Demand/Organic Carbon													
BOD	mg/l	5	-	2.2	-	-	2	<1	1	2	<1	<1	<1
COD	mg/l	40	-	-	-	-	39	21	18	**54**	14	<10	10
Microbiological													
Total Viable Count @22°C	CFU/100ml	-	-	-	-	-	32,000	22,000	12,000	17,000	22,000	23,000	16,000
Total Viable Count @37°C	CFU/100ml	-	-	-	-	-	3,800	390	4,200	1,200	11,000	5,500	4,600
Total coliforms (i.e. Confirmed)	CFU/100ml	0	0	-	-	-	**13**	**9**	**330**	**23**	**800**	**290**	**330**
Faecal coliforms(i.e. Confirmed)	CFU/100ml	0	0	-	-	-	**1**	0	**15**	**3**	**61**	**61**	**97**
Enterococci	CFU/100ml	-	0	-	-	-	**6**	**1**	**3**	**20**	**35**	**35**	**27**
Clostridium pefringens	CFU/100ml	-	0	-	-	-	0	**1**	0	**10**	**1**	**1**	0

Note:

Cadmium - Results of Total Hardness Analysis on 7 surface water samples range from 28ug/l to 93ug/l with 3 of the 7 results <40mg/l. Therefore, a Water Hardness Class I has been selected and as such, a cadmium AA-EQS of 0.08ug/l has been selected (i.e. worse case scenario)

Copper - Results of Total Hardness Analysis on 7 surface water samples range from 28ug/l to 93ug/l and are all <100mg/l. Therefore, a copper AA-EQS of 5ug/l has been selected.

Zinc - Results of Total Hardness Analysis on 7 surface water samples range from 28ug/l to 93ug/l and are all greater than 10mg/l and less than 100mg/l. Therefore, a zinc AA-EQS of 50ug/l has been selected.

450.00	Values are shaded yellow and in RED bold where S.I. No. 272 Surface Water Reg. Threshold Levels are exceeded
450.00	Values are in RED bold where SI No. 294 of 1989 MACs, SI No. 278 of 2007 Parametric Values are exceeded

< = Less than

'-' signifies analysis not carried out on sample or no SI No.293 of 1988 WQS, SI No. 294 of 1989 MACs, SI No. 278 of 2007 Parametric Values, or S.I. No. 272 2007 Surface Water Reg., S.I. No. 386 2015 Surface Water Reg. or S.I. No. 77 2019 Surface Water Reg.Threshold Levels are available.

1. Thresholds have been determined based on A1 Category surface waters as defined by S.I. No. 294 of 1989 MACs. Where limits for A1 Category are not defined A2 or A3 limts have been applied

2. Nutrient thresholds have been determined based on Good Status (mean) limits. Specific pollutants have been determined based on MAC - EQS for inland surface waters. Ammonia Threshold Value refers to Total Ammonia (mg N/l) mean value

APPENDIX 1

TULLYVOGHEEN HISTORIC LANDFILL

SURFACE WATER MONITORING RESULTS

TABLES A1.1 – A1.6

Table A1.1. Results of Volatile Organic Compound laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Tullyvogheen, Clifden, County Galway on 30th August 2022

Parameters	Units	Standards		Guidelines		Analytical Results						
		Dutch Criteria Level TV	Dutch Criteria Level IV	EPA Guideline Values - From Interim Report on 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland' INTERIM GUIDELINE VALUES	EC Environmental Objectives (Groundwater Regulations) Statutory Instrument No. 9, 2010 THRESHOLD VALUES	WA-SW1-01	WA-SW2-01	WA-SW3-01	WA-SW4-01	WA-SW5-01	WA-SW6-01	WA-SW7-01
Dichlorodifluoromethane	mg/l	-	-	-	-	< 0.001	<0.001	<0.001	< 0.001	<0.001	<0.001	<0.001
Chloromethane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vinyl Chloride	mg/l	0.00001	0.00500	-	0.000375	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromomethane	mg/l	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloroethane	mg/l	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Trichlorofluoromethane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	mg/l	0.00001	0.02000	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethene	mg/l	0.00001	0.01000	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethane	mg/l	0.00700	0.90000	0.03	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
tert-butyl methyl ether	mg/l	-	9.20000	0.03	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,2-Dichloroethene	mg/l	0.00001	0.02000	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromochloromethane	mg/l	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dichloroethane	mg/l	0.00700	0.40000	0.003	0.00225	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
1,1,1-Trichloroethane	mg/l	0.00001	0.30000	0.5	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1-Dichloropropene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	mg/l	0.00020	0.03000	0.001	0.00075	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibromomethane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichloropropane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromodichloromethane	mg/l	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Trichloroethene	mg/l	0.02400	0.50000	0.07	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trichloromethane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tetrachloromethane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tribromomethane	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
cis-1,3-Dichloropropene	mg/l	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
trans-1,3-Dichloropropene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,2-Trichloroethane	mg/l	0.00001	0.13000	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Toluene	mg/l	0.00700	1.00000	0.01	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichloropropane	mg/l	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dibromochloromethane	mg/l	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
1,2-Dibromoethane	mg/l	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tetrachloroethene	mg/l	0.0000100	0.04000	0.002	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,1,1,2-Tetrachloroethane	mg/l	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chlorobenzene	mg/l	0.0070000	0.18000	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	mg/l	0.0040000	0.15000	0.01	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
p/m-Xylene	mg/l	0.00020	0.07000	0.01	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Styrene	mg/l	0.00600	0.30000	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
o-Xylene	mg/l	0.00020	0.07000	0.01	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trichloropropane	mg/l	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Isopropylbenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bromobenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Chlorotoluene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Propylbenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chlorotoluene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,4-Trimethylbenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Isopropyltoluene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,3-Dichlorobenzene	mg/l	0.00300	0.05000	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	mg/l	0.00300	0.05000	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
sec-Butylbenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
tert-Butylbenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dichlorobenzene	mg/l	0.00300	0.05000	0.003	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
n-Butylbenzene	mg/l	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2-Dibromo-3-chloropropane	mg/l	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,2,4-Trichlorobenzene	mg/l	0.00001	0.01000	0.0004	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1,2,3-Trichlorobenzene	mg/l	0.00001	0.01000	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Hexachlorobutadiene	mg/l	-	-	0.0001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:

553	Values are underlined wherever Dutch-TV is exceeded
553	Values are shaded yellow and in bold wherever Dutch-IV, EPA Interim Guideline Values or SI 9, 2010 Threshold Values are exceeded
-	'-' = No Dutch TV or IV, EPA Interim Guideline Values or SI 9, 2010 Threshold Values available

Table A1.2. Results of Semi-volatile Organic Compound laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Tullyvogheen, Clifden, County Galway on 30th August 2022

Parameters	Units	Standards		Guidelines		Analytical Results						
		Dutch Criteria Level TV	Dutch Criteria Level IV	EPA Guideline Values - From Interim Report on 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland' INTERIM GUIDELINE VALUES	EC Environmental Objectives (Groundwater Regulations) Statutory Instrument No. 9, 2010. THRESHOLD VALUES	WA-SW1-01	WA-SW2-01	WA-SW3-01	WA-SW4-01	WA-SW5-01	WA-SW6-01	WA-SW7-01
Phenol	mg/l	0.20000	2.00000	0.00050	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Methyl-4,6-Dinitrophenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Chlorophenol	mg/l	0.00030	0.10000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,4-Dichlorophenol	mg/l	0.00020	0.03000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,4-Dimethylphenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Chloro-3-methylphenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,4,6-Trichlorophenol	mg/l	0.00001	0.01000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,4,5-Trichlorophenol	mg/l	0.00001	0.01000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Pentachlorophenol	mg/l	0.00004	0.00300	0.00200	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Methylphenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Methylphenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Nitrophenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Nitrophenol	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,3-Dichlorobenzene	mg/l	0.00300	0.05000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,4-Dichlorobenzene	mg/l	0.00300	0.05000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2-Dichlorobenzene	mg/l	0.00300	0.05000	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
1,2,4-Trichlorobenzene	mg/l	0.00001	0.01000	0.00040	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nitrobenzene	mg/l	-	-	0.01000	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Azobenzene	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Hexachlorobenzene	mg/l	0.00000009	0.00050	0.00003	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Acenaphthylene	mg/l	-	-	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Acenaphthene	mg/l	-	-	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Fluorene	mg/l	-	-	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Pyrene	mg/l	-	-	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(b)fluoranthrene	mg/l	-	-	0.00050	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Naphthalene	mg/l	0.00001	0.07000	0.00100	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Anthracene	mg/l	0.000007	0.00500	10.00000	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phenanthrene	mg/l	0.000003	0.00500	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Fluoranthrene	mg/l	0.000003	0.00100	0.00100	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(a)anthracene	mg/l	0.0000001	0.00050	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chrysene	mg/l	0.0000030	0.00020	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(a)pyrene	mg/l	0.0000005	0.00005	0.00001	0.000000075	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(ghi)perylene	mg/l	0.0000003	0.00005	0.00005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(k)fluoranthrene	mg/l	0.0000004	0.00005	0.00005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Indeno(1,2,3-cd)pyrene	mg/l	0.0000004	0.00005	0.00005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dibenzo(a,h)anthracene	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Chloronaphthalene	mg/l	-	0.006	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Methylnaphthalene	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Carbazole	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Isophorone	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dibenzofuran	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dimethyl phthalate	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Diethyl phthalate	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Di-n-butylphthalate	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Di-n-octylphthalate	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bis(2-ethylhexyl)phthalate	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Butylbenzylphthalate	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Chloroaniline	mg/l	-	0.030	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2-Nitroanaline	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
3-Nitroaniline	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Nitroaniline	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Nitrosodimethylamine	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,4-Dinitrotoluene	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
2,6-Dinitrotoluene	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bis(2-chloroethyl)ether	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bis(2-Chloroisopropyl)Ether	mg/l					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Bromophenylphenylether	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
4-Chlorophenylphenylether	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Hexachloroethane	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Hexachlorobutadiene	mg/l	-	-	0.00010	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Hexchlorocyclopentadiene	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bis(2-chloroethoxy)methane	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-nitrosodi-n-propylamine	mg/l	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Notes:

553	Values are underlined wherever Dutch-TV is exceeded
553	Values are shaded yellow and in bold wherever Dutch-IV, EPA Interim Guideline Values or SI 9, 2010 Threshold Values are exceeded
-	'-' = No Dutch TV or IV, EPA Interim Guideline Values or SI 9, 2010 Threshold Values available

Table A1.3. Results of Organochlorine Pesticides laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Clifden, Co. Galway on 30th August 2022

Parameters	Units	SI 81, 1988 Water Quality (Human Consumption)	Dutch Criteria Level TV	Dutch Criteria Level IV	WA-SW1-01	WA-SW2-01	WA-SW3-01	WA-SW4-01	WA-SW5-01	WA-SW6-01	WA-SW7-01
CHLORINATED PESTICIDES											
Chlordane-Alpha	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trifluralin	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Hexachlorobenzene	µg/l	0.1	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
alpha-HCH(Lindane)	µg/l	0.1	0.000033	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
beta-HCH(Lindane)	µg/l	0.1	0.000008	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
gamma-HCH(Lindane)	µg/l	0.1	0.000009	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
TOTAL HCH Compounds (sum of 3)			0.05	1	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**
Chlorothalonil	µg/l	0.1	-	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Heptachlor	µg/l	0.1	0.000005	0.3	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Heptachlor Epoxide	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
o,p'-DDE	µg/l	0.1	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p,p'-DDE	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
p,p'-TDE(DDD)	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
o,p'-TDE (DDD)	µg/l	0.1	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o,p'-DDT	µg/l	0.1	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p,p'-DDT	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
TOTAL DDD	µg/l	-	0.000000004	0.01	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**
Endosulfan I	µg/l	0.1	0.0000002	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Aldrin	µg/l	0.1	0.000000009	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Endrin	µg/l	0.1	0.0000001	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dieldrin	µg/l	0.1	0.00000004	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
TOTAL DRINS	µg/l	-	-	0.1	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**	**< 0.20**
Endosulfan II	µg/l	0.1	0.0000002	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Endosulfan Sulphate	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Methoxychlor	µg/l	0.1	-	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
MCPA	µg/l	0.1			< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
MCPB	µg/l	0.1			< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Mecoprop	µg/l	0.1			< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
2,4,5-T	µg/l	0.1			< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Notes:

553	Values are underlined wherever Dutch-TV is exceeded
553	Values are shaded yellow and in bold wherever Dutch-IV, SI No. 81 of 1988 MACs, SI No. 439 of 2000 Parametric Values or EPA Guideline Values are exceeded
-	-' signifies analysis not carried out on sample or no Dutch Criteria or EPA Guideline Value is available.

Table A1.4. Results of Organo-phosphorus and Organo-Nitrogen Pesticide laboratory analysis on Surface Water Samples taken from SW1-SW7 at Tullyvogheen Historic Landfill, Tullyvogheen, Clifden on 30th August 2022

Parameters	Units	SI 81, 1988 Water Quality (Human Consumption)	WA-SW1-01	WA-SW2-01	WA-SW3-01	WA-SW4-01	WA-SW5-01	WA-SW6-01	WA-SW7-01
ORGANOPHOSPHOROUS PESTICIDES									
Azinphos-Methyl	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Carbophenothion	µg/l	0.0001	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chlorfenvinphos	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chlorpynifos	µg/l	0.0001	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Coumaphos	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Demeton-O	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Demeton-S	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Diazinon	µg/l	0.0001	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorvos	µg/l	0.0001	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dimethoate	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Disulfoton	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Ethion	µg/l	0.0001	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Fensulphothion	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Fenthion	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Parathion	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Phorate	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Prothiofos	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Propetamphos	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Sulprofos	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trichloronate	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
ORGANONITROGEN PESTICIDES									
Simazine	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Atrazine	µg/l	0.0001	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

553
553
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Notes:

Values are underlined wherever Dutch-TV is exceeded

Values are shaded yellow and in bold wherever Dutch-IV, SI No. 81 of 1988 MACs, SI No. 439 of 2000 Parametric Values or EPA Guideline Values are exceeded

-' signifies analysis not carried out on sample or no Dutch Criteria or EPA Guideline Value is available.

Table A1.5. Results of Field Multiprobe Readings on Surface Water Samples taken from Locations SW1 to SW7 on stream adjacent to Tullyvogheen Historic Landfill and on the Owenglen River on the 30th August, 2022

Monitoring Date	Monitoring Point	Monitoring Time	Temperature	pH	mvpH [9]	ORP [1]	Conductivity [2]	Absolute conductivity [3]	Resistivity [4]	Total Disssolved Solids (TDS)	Salinity [5]	Seawater Density [6]	Atmosphere. Pressure [7]	DO	DO	Turbidity [8]
			°C			mv	µS/cm	µS/cm	MΩcm	ppm	PSU	σt	psi	%	ppm	FNU
30.08.2022	SW1	08:40:00	—	6.51	-13.88	101.46	280.57	220.46	3564.27	140.10	0.13	0.00	14.77	1.23	0.13	1.45
	SW2	09:23:16	—	6.88	-33.69	-94.78	566.38	440.79	13559.00	283.26	0.28	0.00	14.78	7.11	0.75	2.14
	SW3	10:03:03	—	7.39	-61.64	-15.40	395.76	315.63	2528.08	197.93	0.19	0.00	14.78	11.04	1.13	18.89
	SW4	11:18:35	—	7.73	-80.92	100.63	284.79	238.90	3523.29	142.38	0.14	0.00	14.86	14.82	1.46	4.35
	SW5	12:02:12	—	7.42	-63.44	108.85	329.62	273.82	3035.56	164.74	0.16	0.00	14.87	12.43	1.24	3.21
	SW6	12:31:25	—	7.58	-72.77	125.37	152.00	130.44	6579.06	76.00	0.07	0.00	14.85	12.07	1.17	0.73
	SW7	13:34:25	—	7.46	-66.12	133.07	173.59	149.26	5760.67	86.74	0.08	0.00	14.86	11.70	1.13	0.73

Notes:

1. ORP - signifies Oxidation Reduction Potential. Oxidation-reduction potential, or ORP, is a measurement that indicates the degree to which a substance is capable of oxidizing or reducing another substance. ORP is measured in millivolts (mV).

2. Conductivity (µS/cm) - Electrical conductivity is denoted by the symbol σ and has SI units of microsiemens per centimeter (µS/cm). If the conductivity changes along with the temperature change of a solution and it is a known characteristic, the conductivity measurement can be corrected to a reference temperature by carefully measuring the solution temperature (typically 20 or 25°C)

3. Absolute Conductivity (µS/cm) - Absolute conductivity is an EC measurement without temperature compensation.

4. Resistivity (MΩcm) - Resistivity in water, measured in milliohm-meters, is the measure of the ability of water to resist an electrical current, which is directly related to the amount of dissolved salts in the water. Water with a high concentration of dissolved salts will have a low resistivity, and vice versa. Resistivity is measured in Ohms.

5. Salinity (PSU) - Ocean salinity is generally defined as the salt concentration (e.g., Sodium and Chlorine) in sea water. It is measured in unit of PSU (Practical Salinity Unit), which is a unit based on the properties of sea water conductivity. It is equivalent to per thousand or (o/00) or to g/kg.

6. Seawater Density (σt) - Oceanographers use a density unit called sigma-t (σt). This value is obtained by subtracting 1.0 from the density and multiplying the remainder by 1,000. The σt has no units and is an abbreviated density of seawater controlled by salinity and temperature only. The σt of seawater increases with increasing salinity and decreasing temperature.

7. Atmospheric Pressure (PSI) - PSI signifies 'Pounds per square inch'. Normal atmospheric pressure is 14.7 psi, which means that a column of air one square inch in area rising from the Earth's atmosphere to space weighs 14.7 pounds. Atmosphere. (atm) Normal atmospheric pressure is defined as 1 atmosphere.

8. FNU - signifies 'Formazin Nephelometric Unit (FNU)' is similar to a Nephelometric Turbidity Unit (NTU) in that both measure scattered light at 90 degrees from the incident light beam, but the FNU is measured with an infrared light source as opposed to white light for NTU. FNU is most often used when referencing the ISO 7027 (European) turbidity method.

Table A1.6. Major Ion Balance on Surface Water Samples (SW1-SW7) taken at Surface Water Bodies at Tullyvogheen Historic Landfill, Clifden (30th August 2022)

		Cations				Anions			Balance			
Sample	Elec. Cond. (μScm^{-1})	Ca^{2+} (meq L^{-1})	Mg^{2+} (meq L^{-1})	Na^{+} (meq L^{-1})	K^{+} (meq L^{-1})	Cl^{-} (meq L^{-1})	SO_4^{2-} (meq L^{-1})	HCO_3^{-} (meq L^{-1})	$\sum^{+}$ (meq L^{-1})	$\sum^{-}$ (meq L^{-1})	% Ion Balance Error	pH
WA-SW1-01	320	0.39	0.35	1.22	0.02	1.21	0.00	0.61	1.97	1.82	3.94	8.0
WA-SW2-01	250	1.37	0.49	1.74	0.05	1.49	0.00	2.35	3.65	3.85	-2.66	8.1
WA-SW3-01	240	0.78	0.35	1.43	0.03	1.18	0.00	1.01	2.60	2.20	8.49	7.9
WA-SW4-01	230	0.74	0.35	1.30	0.03	1.16	0.00	1.18	2.43	2.33	1.97	7.8
WA-SW5-01	240	0.78	0.38	1.26	0.03	1.13	0.00	1.27	2.46	2.40	1.20	7.8
WA-SW6-01	120	0.00	0.21	0.57	0.01	0.54	0.00	0.49	0.79	1.03	-12.96	7.9
WA-SW7-01	120	0.00	0.23	0.65	0.02	0.59	0.00	0.52	0.90	1.11	-10.50	7.8

APPENDIX 2.

TULLYVOGHEEN HISTORIC LANDFILL SURFACE WATER MONITORING

RAW VALIDATED LABORATORY RESULTS –

EUROFINS CHEMTEST UK

CLS LABORATORY ROSMUC, CO. GALWAY

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-33447-1
Initial Date of Issue:	08-Sep-2022
Client	MULROY ENVIRONMENTAL
Client Address:	30 Lisroland View Knockbridge Dundalk County Louth Ireland
Contact(s):	Fergal Connolly Padriac Mulroy
Project	Clifden
Quotation No.:	Q21-24673
Order No.:	
No. of Samples:	14
Turnaround (Wkdays):	5
Date Approved:	08-Sep-2022
Approved By:	
Details:	Stuart Henderson, Technical Manager

Date Received:	02-Sep-2022
Date Instructed:	02-Sep-2022
Results Due:	08-Sep-2022

Results - Water

Project: Clifden

Client: MULROY ENVIRONMENTAL			**Chemtest Job No.:**		22-33447	22-33447	22-33447	22-33447	22-33447	22-33447	22-33447	22-33447
Quotation No.: Q21-24673			**Chemtest Sample ID.:**		1498628	1498629	1498630	1498631	1498632	1498633	1498634	1498635
			Client Sample ID.:		WA-SW1-01	WA-SW1-01 Filtered	WA-SW2-01	WA-SW2-01 Filtered	WA-SW3-01	WA-SW3-01 Filtered	WA-SW4-01	WA-SW4-01 Filtered
			Sample Type:		WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
			Date Sampled:		30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Potassium/Sodium Ratio	N	1415		N/A	1/46.1		1/20.5		1/27.0		1/23.8	
pH	U	1010		N/A	8.0		8.1		7.9		7.8	
Electrical Conductivity	U	1020	µS/cm	1.0	320		250		240		230	
Suspended Solids At 105C	U	1030	mg/l	5.0	< 5.0		10		< 5.0		10	
Dissolved Oxygen	N	1150	mg O2/l	0.50	6.3		6.4		6.7		6.5	
Redox Potential	N	1170	mV	N/A	54		66		70		76	
Alkalinity (Total)	U	1220	mg/l	10	26		100		43		50	
Chloride	U	1220	mg/l	1.0	43		53		42		41	
Nitrite as NO2	U	1220	mg/l	0.020	< 0.020		0.027		0.12		< 0.020	
Nitrate as NO3	U	1220	mg/l	0.50	< 0.50		0.87		0.84		4.3	
Phosphate as P	U	1220	mg/l	0.050	< 0.050		< 0.050		< 0.050		< 0.050	
Sulphate	U	1220	mg/l	1.0	< 1.0		< 1.0		4.1		1.7	
Cyanide (Total)	U	1300	µg/l	50.0	< 50		< 50		< 50		< 50	
Sulphide	U	1325	mg/l	0.050	[B] < 0.050		[B] < 0.050		[B] < 0.050		[B] < 0.050	
Calcium (Dissolved)	U	1455	mg/l	2.00	7.9		28		16		15	
Potassium (Dissolved)	U	1455	mg/l	0.50	0.61		2.0		1.2		1.3	
Magnesium (Dissolved)	U	1455	mg/l	0.20	4.3		5.9		4.3		4.3	
Sodium (Dissolved)	U	1455	mg/l	1.50	28		40		33		30	
Total Hardness as CaCO3	U	1270	mg/l	15	37		93		57		56	
Arsenic (Dissolved)	U	1455	µg/l	0.20		0.50		0.46		0.44		0.27
Boron (Dissolved)	U	1455	µg/l	10.0		30		71		45		60
Cadmium (Dissolved)	U	1455	µg/l	0.11		< 0.11		< 0.11		< 0.11		< 0.11
Chromium (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50		< 0.50
Copper (Dissolved)	U	1455	µg/l	0.50		3.1		0.55		2.5		0.64
Iron (Dissolved)	N	1455	µg/l	5.0		620		3100		800		410
Mercury (Dissolved)	U	1455	µg/l	0.05		< 0.05		< 0.05		< 0.05		< 0.05
Manganese (Dissolved)	U	1455	µg/l	0.50		270		390		240		12
Nickel (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		0.60		0.50
Lead (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50		< 0.50
Antimony (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50		< 0.50
Selenium (Dissolved)	U	1455	µg/l	0.50		1.0		0.63		< 0.50		< 0.50
Zinc (Dissolved)	U	1455	µg/l	2.5		14		110		11		9.5

Results - Water

Project: Clifden

Client: MULROY ENVIRONMENTAL			**Chemtest Job No.:**		22-33447	22-33447	22-33447	22-33447	22-33447	22-33447
Quotation No.: Q21-24673			**Chemtest Sample ID.:**		1498636	1498637	1498638	1498639	1498640	1498641
			Client Sample ID.:		WA-SW5-01	WA-SW5-01 Filtered	WA-SW6-01	WA-SW6-01 Filtered	WA-SW7-01	WA-SW7-01 Filtered
			Sample Type:		WATER	WATER	WATER	WATER	WATER	WATER
			Date Sampled:		30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022	30-Aug-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Potassium/Sodium Ratio	N	1415		N/A	1/23.6		1/22.8		1/22.9	
pH	U	1010		N/A	7.8		7.9		7.8	
Electrical Conductivity	U	1020	µS/cm	1.0	240		120		120	
Suspended Solids At 105C	U	1030	mg/l	5.0	< 5.0		< 5.0		< 5.0	
Dissolved Oxygen	N	1150	mg O2/l	0.50	6.2		6.4		6.9	
Redox Potential	N	1170	mV	N/A	84		91		95	
Alkalinity (Total)	U	1220	mg/l	10	54		21		22	
Chloride	U	1220	mg/l	1.0	40		19		21	
Nitrite as NO2	U	1220	mg/l	0.020	< 0.020		< 0.020		< 0.020	
Nitrate as NO3	U	1220	mg/l	0.50	3.4		< 0.50		< 0.50	
Phosphate as P	U	1220	mg/l	0.050	< 0.050		< 0.050		< 0.050	
Sulphate	U	1220	mg/l	1.0	5.3		3.1		4.0	
Cyanide (Total)	U	1300	µg/l	50.0	< 50		< 50		< 50	
Sulphide	U	1325	mg/l	0.050	[B] < 0.050		[B] < 0.050		[B] < 0.050	
Calcium (Dissolved)	U	1455	mg/l	2.00	16		5.5		6.6	
Potassium (Dissolved)	U	1455	mg/l	0.50	1.3		0.57		0.64	
Magnesium (Dissolved)	U	1455	mg/l	0.20	4.6		2.6		2.8	
Sodium (Dissolved)	U	1455	mg/l	1.50	29		13		15	
Total Hardness as CaCO3	U	1270	mg/l	15	59		24		28	
Arsenic (Dissolved)	U	1455	µg/l	0.20		0.29		0.35		0.23
Boron (Dissolved)	U	1455	µg/l	10.0		63		32		28
Cadmium (Dissolved)	U	1455	µg/l	0.11		< 0.11		< 0.11		< 0.11
Chromium (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50
Copper (Dissolved)	U	1455	µg/l	0.50		0.61		< 0.50		0.73
Iron (Dissolved)	N	1455	µg/l	5.0		430		290		250
Mercury (Dissolved)	U	1455	µg/l	0.05		< 0.05		< 0.05		< 0.05
Manganese (Dissolved)	U	1455	µg/l	0.50		21		7.6		5.6
Nickel (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50
Lead (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50
Antimony (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50
Selenium (Dissolved)	U	1455	µg/l	0.50		< 0.50		< 0.50		< 0.50
Zinc (Dissolved)	U	1455	µg/l	2.5		8.0		7.6		5.0

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1498628		WA-SW1-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498628		WA-SW1-01		30-Aug-2022	B	EPA Vial 40ml
1498628		WA-SW1-01		30-Aug-2022	B	Plastic Bottle 1000ml
1498630		WA-SW2-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498630		WA-SW2-01		30-Aug-2022	B	EPA Vial 40ml
1498630		WA-SW2-01		30-Aug-2022	B	Plastic Bottle 1000ml
1498632		WA-SW3-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498632		WA-SW3-01		30-Aug-2022	B	EPA Vial 40ml
1498632		WA-SW3-01		30-Aug-2022	B	Plastic Bottle 1000ml
1498634		WA-SW4-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498634		WA-SW4-01		30-Aug-2022	B	EPA Vial 40ml
1498634		WA-SW4-01		30-Aug-2022	B	Plastic Bottle 1000ml
1498636		WA-SW5-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498636		WA-SW5-01		30-Aug-2022	B	EPA Vial 40ml
1498636		WA-SW5-01		30-Aug-2022	B	Plastic Bottle 1000ml
1498638		WA-SW6-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498638		WA-SW6-01		30-Aug-2022	B	EPA Vial 40ml
1498638		WA-SW6-01		30-Aug-2022	B	Plastic Bottle 1000ml
1498640		WA-SW7-01		30-Aug-2022	B	Coloured Winchester 1000ml
1498640		WA-SW7-01		30-Aug-2022	B	EPA Vial 40ml
1498640		WA-SW7-01		30-Aug-2022	B	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1030	Total Suspended Solids	Total suspended solids	Filtration of a mixed sample through a standard glass fibre filter and determination of the mass of residue retained dried at 105°C.
1150	Dissolved Oxygen	Dissolved Oxygen (DO)	Electrometric determination (on site preferred), using oxygen sensitive membrane electrode.
1170	Redox Potential	Redox Potential	Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N–dimethyl-pphenylenediamine.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Padraic Mulroy
Mulroy Environmental
30 Lisroland View
Knockbridge
Dundalk CO Louth

Report No. : 496906
Date of Receipt : 30/08/2022
Start Date of Analysis : 30/08/2022
Date of Report : 08/09/2022
Order Number : Tullyvogheen-LF
Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
1522799	WA-SW1-01	T.V.C. @ 22°C (Pour Plate)	I,R	32,000 est	cfu/ml
		T.V.C. @ 37 (Pour Plate)	I,R	3,800	cfu/ml
		BOD	I,R	2	mg/l
		COD	I,R	39	mg/l
		Ammonia as NH3-N	I,R	0.058	mg/l
		Ammonium as NH4	I,R	0.075	mg/l
		Clostridium Perfringens in Water	I,R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I,R	13	cfu/100ml
		Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	6	cfu/100ml
		Faecal Coliforms Filtration	I,R	1	cfu/100ml
1522800	WA-SW2-01	Faecal Coliforms Filtration	I,R	0	cfu/100ml
		Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	1	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I,R	9	cfu/100ml
		Clostridium Perfringens in Water	I,R	1	cfu/100ml
		COD	I,R	21	mg/l
		Ammonium as NH4	I,R	2.31	mg/l
		Ammonia as NH3-N	I,R	1.79	mg/l
		T.V.C. @ 37 (Pour Plate)	I,R	390	cfu/ml
		BOD	I,R	<1	mg/l
		T.V.C. @ 22°C (Pour Plate)	I,R	22,000	cfu/ml
1522801	WA-SW3-01	T.V.C. @ 22°C (Pour Plate)	I,R	12,000	cfu/ml
		BOD	I,R	1	mg/l
		T.V.C. @ 37 (Pour Plate)	I,R	4,200	cfu/ml
		Ammonia as NH3-N	I,R	0.763	mg/l
		Ammonium as NH4	I,R	0.984	mg/l
		COD	I,R	18	mg/l
		Clostridium Perfringens in Water	I,R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I,R	330 Result obtained from a 1 in 10 dilution	cfu/100ml
		Faecal Coliforms Filtration	I,R	15	cfu/100ml
		Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	3	cfu/100ml
1522802	WA-SW4-01	Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	20	cfu/100ml
		Faecal Coliforms Filtration	I,R	3	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I,R	23	cfu/100ml
		Clostridium Perfringens in Water	I,R	10	cfu/100ml
		Ammonium as NH4	I,R	<0.01	mg/l
		Ammonia as NH3-N	I,R	<0.005	mg/l
		T.V.C. @ 37 (Pour Plate)	I,R	1,200	cfu/ml
		COD	I,R	54	mg/l

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Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma; F:Field test; O:Tested outside hold time.

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		BOD	I,R	2	mg/l
		T.V.C. @ 22°C (Pour Plate)	I,R	17,000	cfu/ml
1522803	WA-SW5-01	T.V.C. @ 22°C (Pour Plate)	I,R	22,000	cfu/ml
		BOD	I,R	<1	mg/l
		COD	I,R	14	mg/l
		T.V.C. @ 37 (Pour Plate)	I,R	11,000	cfu/ml
		Ammonia as NH3-N	I,R	0.025	mg/l
		Ammonium as NH4	I,R	0.032	mg/l
		Clostridium Perfringens in Water	I,R	74	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I,R	800 Result obtained from a 1 in 10 dilution	cfu/100ml
		Faecal Coliforms Filtration	I,R	28	cfu/100ml
		Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	35	cfu/100ml
1522804	WA-SW6-01	Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	35	cfu/100ml
		Faecal Coliforms Filtration	I,R	61	cfu/100ml
		Clostridium Perfringens in Water	I,R	1	cfu/100ml
		Ammonium as NH4	I,R	<0.01	mg/l
		Total Coliforms (Filtration) (Environmental Waters)	I,R	290 Result obtained from a 1 in 10 dilution	cfu/100ml
		Ammonia as NH3-N	I,R	<0.005	mg/l
		T.V.C. @ 37 (Pour Plate)	I,R	5,500	cfu/ml
		COD	I,R	<10	mg/l
		BOD	I,R	<1	mg/l
		T.V.C. @ 22°C (Pour Plate)	I,R	23,000	cfu/ml
1522805	WA-SW7-01	T.V.C. @ 22°C (Pour Plate)	I,R	16,000	cfu/ml
		T.V.C. @ 37 (Pour Plate)	I,R	4,600	cfu/ml
		BOD	I,R	<1	mg/l
		COD	I,R	10	mg/l
		Ammonia as NH3-N	I,R	<0.005	mg/l
		Ammonium as NH4	I,R	<0.01	mg/l
		Clostridium Perfringens in Water	I,R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I,R	330 Result obtained from a 1 in 10 dilution	cfu/100ml
		Enterococci (Waters- Incubated at 37°C and 44 °C)	I,R	27	cfu/100ml
		Faecal Coliforms Filtration	I,R	97	cfu/100ml

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by:

James Feighan
Scientific Project Manager

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
0cfu is reported in waters, this refers to 'not detected in volume tested'
It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.CLS will test food, water and swabs samples within 24 hours of receipt.
Where samples have been taken by the Client, results apply to the samples as received.

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In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
T.V.C. @ 22°C (Pour Plate)	CLS 95	±7.96 cfu/ml	Yes	No	Yes
T.V.C. @ 37 (Pour Plate)	CLS 95	±6.62 cfu/ml	Yes	No	Yes
BOD	CLS 12	+/- 9.33 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
Ammonia as NH3-N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Ammonium as NH4	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Clostridium Perfringens in Water	CLS 43	±2.35 cfu/ml	Yes	No	Yes
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	±2.76 cfu/100ml	Yes	No	Yes
Enterococci (Waters- Incubated at 37°C and 44 °C)	CLS 42	±2.64 cfu/100ml	Yes	No	Yes
Faecal Coliforms Filtration	CLS 16 based on The Microbiology of Recreational and Environmental Waters 2000	±4.38 cfu/100ml	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.
For environmental samples of lakes and rivers sampled by CLS, accreditation is not being claimed on this report.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1522799	WA-SW1-01	Good condition	30/08/2022
1522800	WA-SW2-01	Good condition	30/08/2022
1522801	WA-SW3-01	Good condition	30/08/2022
1522802	WA-SW4-01	Good condition	30/08/2022
1522803	WA-SW5-01	Good condition	30/08/2022
1522804	WA-SW6-01	Good condition	30/08/2022
1522805	WA-SW7-01	Good condition	30/08/2022

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APPENDIX 3

TULLYVOGHEEN HISTORIC LANDFILL

SURFACE WATER MONITORING LOGS

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
Project:	Tullyvogheen Historic Landfill - Surface Water Risk Assessment
Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW1**	**Grid Reference:**	(E) 67784.14
			(N) 251182.815

PHYSICO-CHEMICAL PARAMETERS			
pH:	6.51		
Electrical Conductivity (µs/cm):	280.57		
Dissolved Oxygen (mg/l)	1.23		
Turbidity (FNU)	1.45		
Oxidation Reduction Potential (ORP) (mV)	101.46		

FIELD OBSERVATIONS	
Colour:	Brown tannins from upland peat, high in suspended solids
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
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Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW2**	**Grid Reference:**	(E) 67512.244
			(N) 251149.22

PHYSICO-CHEMICAL PARAMETERS			
pH:	6.88		
Electrical Conductivity (µs/cm):	566.38		
Dissolved Oxygen (mg/l)	7.11		
Turbidity (FNU)	2.14		
Oxidation Reduction Potential (ORP) (mV)	-94.78		

FIELD OBSERVATIONS	
Colour:	Iron oxide scum on gravel strata along stream bed, iron suspended solids in sample
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
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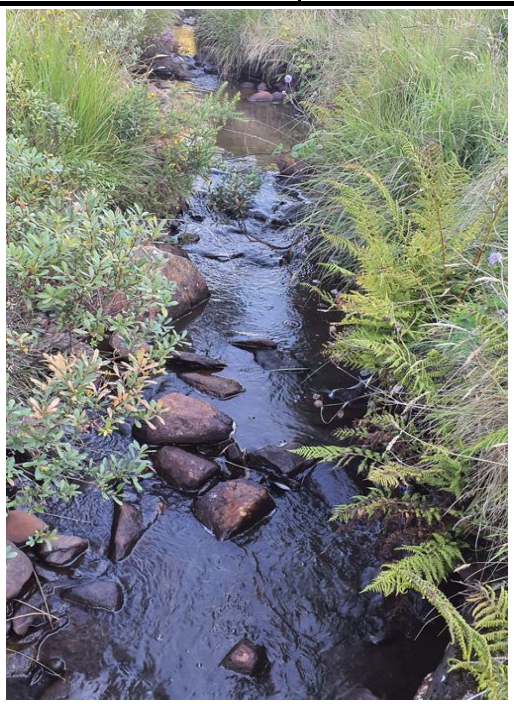
Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW3**	**Grid Reference:**	(E) 67468.152 (N) 251092.544



PHYSICO-CHEMICAL PARAMETERS			
pH:	7.39		
Electrical Conductivity (µs/cm):	395.76		
Dissolved Oxygen (mg/l)	11.04		
Turbidity (FNU)	18.89		
Oxidation Reduction Potential (ORP) (mV)	-15.40		

FIELD OBSERVATIONS	
Colour:	None
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
Project:	Tullyvogheen Historic Landfill - Surface Water Risk Assessment
Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW4**	**Grid Reference:**	(E) 67297.458
			(N) 250784.389

PHYSICO-CHEMICAL PARAMETERS			
pH:	7.73		
Electrical Conductivity (µs/cm):	284.79		
Dissolved Oxygen (mg/l)	14.86		
Turbidity (FNU)	4.35		
Oxidation Reduction Potential (ORP) (mV)	100.63		

FIELD OBSERVATIONS	
Colour:	None
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
Project:	Tullyvogheen Historic Landfill - Surface Water Risk Assessment
Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW5**	**Grid Reference:**	(E) 67310.317
			(N) 250508.951

PHYSICO-CHEMICAL PARAMETERS			
pH:	7.42		
Electrical Conductivity (µs/cm):	329.62		
Dissolved Oxygen (mg/l)	12.43		
Turbidity (FNU)	3.21		
Oxidation Reduction Potential (ORP) (mV)	108.85		

FIELD OBSERVATIONS	
Colour:	None
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
Project:	Tullyvogheen Historic Landfill - Surface Water Risk Assessment
Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW6**	**Grid Reference:**	(E) 67338.942
			(N) 250440.213

PHYSICO-CHEMICAL PARAMETERS			
pH:	7.58		
Electrical Conductivity (µs/cm):	152.00		
Dissolved Oxygen (mg/l)	12.07		
Turbidity (FNU)	0.73		
Oxidation Reduction Potential (ORP) (mV)	125.37		

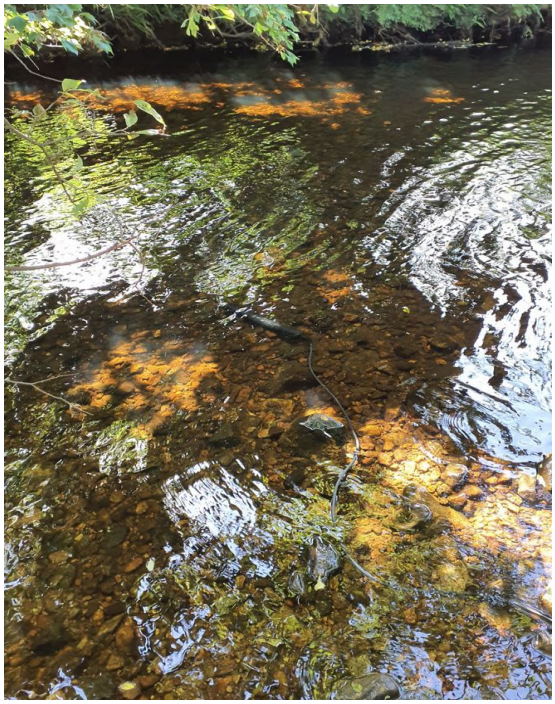
FIELD OBSERVATIONS	
Colour:	None
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental

SURFACE WATER FIELD SAMPLING LOG

PROJECT DETAILS	
Project:	Tullyvogheen Historic Landfill - Surface Water Risk Assessment
Location:	Tullyvogheen, Clifden, County Galway
Sampler(s):	Padraic Mulroy/Tara Murray
Date:	30/08/2022

MONITORING POINT DETAILS			
Monitoring Point No.:	**SW7**	**Grid Reference:**	(E) 67311.379
			(N) 250452.124



PHYSICO-CHEMICAL PARAMETERS			
pH:	7.46		
Electrical Conductivity (µs/cm):	173.59		
Dissolved Oxygen (mg/l)	11.70		
Turbidity (FNU)	0.73		
Oxidation Reduction Potential (ORP) (mV)	133.07		

FIELD OBSERVATIONS	
Colour:	None
Odour:	None
Sheen or Product Film:	None
Emulsified Product:	None

MULROY environmental